The
Electrical Review

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Railway Traction To-day

ONE of the chief objects of the British Association is the bringing of the scientist and the ordinary man into closer touch, but some of the papers presented at the York meeting, informative though they were to the specialist, must have been very much above the heads of any lay component of the audience. It was fortunate that the paper by Mr. F. Lydall on "Railway Traction by Electric Power," with which the non-engineer is so closely concerned, avoided technicalities and stressed the economic aspects.

The situation is very different now from what it was last May, when the Weir Report was issued. Falling traffic and revenue and a national financial crisis do not favour consideration of the huge capital expenditure involved in complete electrification of the main lines. But, as Mr. Lydall pointed out, these very conditions make it even more important to search for any economies, such as those which electrification may offer.

The economic justification for an electrification scheme is either that it will increase revenue sufficiently to meet the new capital charges by attracting passengers, owing to the more frequent and quicker service provided, or that it will reduce working expenses sufficiently to the same end. Our suburban lines have been electrified for the first reason; main line electrification must depend largely upon the second, especially with regard to fuel, wages, and repairs and maintenance.

The very efficiency of the British steam locomotive weakens the will to make a drastic change, and, as Sir Josiah Stamp implied in discussing the paper, improvements in its performance are taking place which prevent its becoming obsolete.

But the chief difficulty with electrification on the system to which the Weir Report gave most prominence, *i.e.*, with electricity supplied from external centralised power stations, is that the change-over cannot be done piecemeal; this has caused a certain amount of interest to be taken in the possibility of using battery or oil-electric locomotives instead.

The weight of the battery is certainly a handicap in many instances, and its field of application in this country appears to be limited. Oil-electric locomotives have recently given an excellent account of themselves, but apart from their dependence on an imported fuel, we cannot see why the reasons for supplying electric motors in industrial workshops from the public mains should not be equally applicable to railroad conditions. Nevertheless, as Mr. C. H. Merz pointed out in the subsequent discussion, the oil engine might have a useful field under certain conditions.

Although we do not anticipate that any very great amount of capital expenditure will be sanctioned in the near future for main-line electrification, it should be possible to do something more modest as a start. Capt. J. M. Donaldson suggested a few months ago that a line not exceeding 200 route miles should be changed over to provide initial data. If selected carefully, such an electrified line, preferably with a small amount of passenger traffic in proportion to shunting, should be able to pay its way, if the evils of dual working (by steam and electricity) were avoided.

Meanwhile, much more might be done than is actively contemplated in the direction of suburban electrification, although we must give due acknowledgment to the L.M.S. Railway Co. for its Barking-Upminster electrification and its active pursuance of the scheme for electrifying the Carlisle-Crewe lines, which is now under the consideration of financial experts.

Public Lighting Engineers

SEVERAL speakers this week at the conference of the Association of Public Lighting Engineers referred to the need in each large town of an engineer ranking as a chief official who could advise his committee from an independent standpoint on lighting problems. From Sheffield came the evidence of a city councillor (expressed in £ s. d.) that the appointment of a properly qualified man there has cost considerably less than nothing, having regard to the remarkable improvement in illuminating efficiency brought about under his control—an increase of

348 per cent. in candle-power and 28 per cent. in cost. An increase in expenditure on public lighting must be expected in the future, as the present standards of street lighting are very rarely good enough, but this expenditure cannot be entrusted to inexpert men if we are to achieve what we aim at. The type of men we have in mind as public lighting engineers would be able to work out the best system to adopt for any given area with the aid of the data given in Mr. G. H. Wilson's paper on "Modern Electric Street Lighting," which we review on a later page.

The Farm Load

MR. W. B. WOODHOUSE, in the discussion on Mr. Borlase Matthews's B.A. paper, speaking from his experience in Yorkshire, deprecated the taking of too rosy a view as to the revenue to be derived from supplying rural districts. He gave an average annual consumption of 1,500 kWh for farm supplies. This is not a big figure, and is equalled by many partly electrically equipped residences in towns. It is, nevertheless, much higher than the consumption (exclusive of irrigation) in the United States, where the amount used by each of nearly 500,000 farms in the Eastern States averages only 775 kWh, according to the latest N.E.L.A. report. No one would stand for the withholding of supplies to rural areas, and the only thing to do is to make the most of them by putting specially trained men on to the work. The same report states that there are approximately 1,000 men with supply companies in America who devote part or full time to developing the load of the countryside. That indicates the lines along which the job should be tackled; the future is with the consumers' engineer.

The Canadian Market

THE American hold upon the electrical apparatus market of the Dominion of Canada is strikingly emphasised by the lists of electrical equipment approved by the Hydro-Electric Power Commission of Ontario from time to time. The latest, which covers the first four months of the current year, comprises forty closely printed octavo pages setting out many kinds of electrical appliances with their manufacturers' names, brief descriptions, and ratings. A search through this mass of matter yields the names of only three British manufacturers; there is a goodly number of Canadian firms' names, but the greater part of the list is undoubtedly American. As our readers are aware, the two principal reasons for this are the proximity of the United States and the penetration of American capital and ideas into Canada. There is, however, a loss of trade due to a lack of interest in the Canadian market on the part of British manufacturers, combined with a reluctance to adapt their products to Canadian requirements. The fact that *some* English names appear in the Commission's lists indicate that the position is not entirely hopeless, and maybe our manufacturers will find that reconsideration of the question is worth while.

Research

THAT the services rendered in connection with research work conducted by the different specialist associations are of high value is unquestioned and, indeed unquestionable. This fact has been brought out again in the evidence submitted to the Committee on New Industrial Development, which was set up by the Economic Advisory Council. The report recently issued (signed by Mr. J. H. Thomas as chairman, and among others by Sir Andrew Duncan, chairman of the Central Electricity Board) reaches the conclusion that no new research organisation purely for industrial research is necessary; indeed, it holds that such an organisation would cut right across the existing Department of Scientific and Industrial Research. The Government Department mentioned is described as efficient and sufficiently flexible to be able to develop in accordance with the changing needs of industry. The Committee holds that there should be at the disposal of the Government a small fund for industrial research developments, such as that now available for the existing Department, and it also expresses the hope that Government financial assistance will continue to be given to the research associations until industry is able to bear the whole of the cost. If electricity is the life-blood of industry, what is research?

British Plant in Japan

DURING the past few years Japanese purchases of British electrical machinery have shown a sharp decline. The total value of Japan's imports of this class in 1927 was £318,000. Last year it had fallen to £25,000; in fact, the imports of some classes, *e.g.*, rotary convertors, ceased altogether. At the same time, it is clear that the trade has not been entirely lost. This is demonstrated by the article on the new Kokura power station, which appears in this issue. The Metropolitan-Vickers Co. is to be congratulated upon securing the order for the two 25,000-kW high-speed turbo-alternators for this station, the four new boilers are of Babcock and Wilcox manufacture, and the auxiliaries also include a number of items of British production.

A Favourable Comparison

To those who rule out electric space heating in any form as economically impossible with electricity at anything above 0.5d. per kWh we refer the comparative results for the three Lincoln school-heating installations dealt with in this issue. Electricity wins easily at 0.75d. per kWh, for, apart from the fact that the electrically heated school is in a more exposed position than the other two, the saving in space by virtue of there being no boiler and fuel-storage requirements, the greater cleanliness, and, above all, the greater ease of control, render void the slight advantage shown in actual figures for the coke-fired installation. This is one of the first of many instances which will support our oft-repeated contention that the great advantage which electrical installations have by way of economical control, etc., will make the electrical method of space heating most desirable.

A New House

THE all-electric house at Birmingham, of which we give an account on another page, is of more than usual interest for several reasons. Pains have been taken to demonstrate the fact that it is simpler and cheaper to build an "all-electric" dwelling than one with coal fires and chimneys and all that they involve by way of constructional design and building work. The house is an effort by a company—the All-Electric House Company—in which various electrical interests have joined hands, and every effort has been made to embody apparatus and devices which demonstrate very clearly the manifold ways in which electricity can be made to ensure good lighting, warmth, and comfort in the domestic circle, to prevent that tired feeling, and to promote peace and harmony. Congratulations are due to the Birmingham Circle of the British Electrical Development Association for initiating this effective demonstration, and we hope and believe that the publicity which the matter received from the presence of the Lord Mayor of Birmingham at the opening will excite a lasting interest on the part of the people. Admission to the new All-Electric Home is free to all comers.

Welcome News

WE have become so accustomed to the gradual raising of the Australian tariff wall, that the removal of some of the bricks of that barrier comes as a shock—albeit a welcome one. And when it is announced that the proposals of the Commonwealth Treasurer (Mr. Lyons, who is also Prime Minister) include the lowering of the duty on dynamo-electric machinery the news seems too good to be true. Better still, further revisions are promised, and these may prove a much-needed stimulant to our drooping Australian export trade.

Some of the Apartments in the New Building Centre, Bond Street, W.1

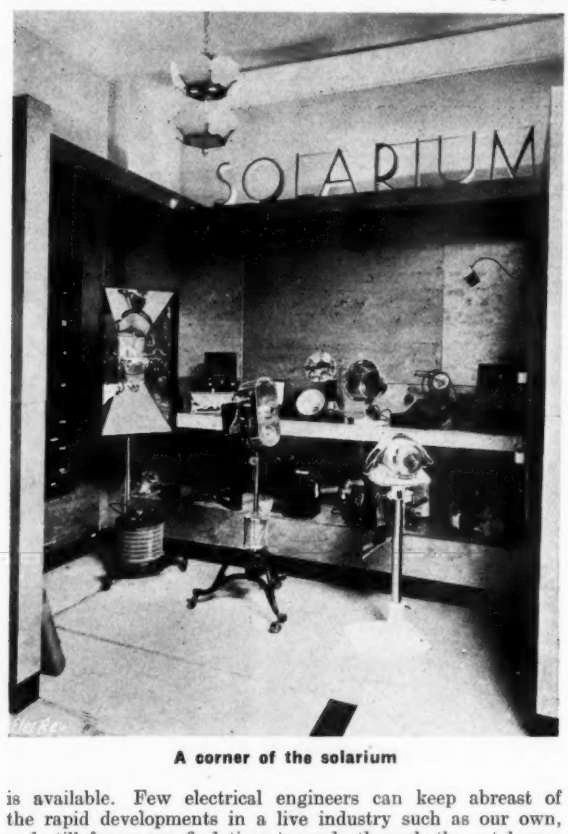
1. The heating bay in the Electrical Section. 2. An all-electric bathroom. 3. Sunlight-tube lighting on the ground floor. 4. An electric fountain on the first floor. 5. The hospital lighting exhibit. 6. The entrance hall and inquiry office.

The Building Centre

Notes on the features of electrical interest

THE growing appreciation by the public of the advantages of electrical methods, the increasing availability of supply, and the downward tendencies in tariffs, coupled with the idea that good service to the consumer blesses him that gives as well as him that takes, gives promise of a notable move forward as soon as trade conditions improve.

In order to do so, we must have a thorough knowledge of what electricity can do for us and what electrical apparatus



A corner of the solarium

is available. Few electrical engineers can keep abreast of the rapid developments in a live industry such as our own, and still fewer can find time to wade through the catalogues of a tithe of the manufacturing firms that offer admirable appliances of whose existence many people are unaware.

If this be true of the electrical engineer, it is more so of people such as architects and builders to whom electrical development will owe much, and still more true of the man in the street, to whose initiative so many inquiries will be due.

A Co-operative Effort

Any attempt at presenting a survey of what the electrical trade, or any section of it, has to offer, is of the utmost value, and the British Electrical Development Association, in installing the lighting and wiring and in equipping the electrical section of the Building Centre at 158, New Bond Street, W. (which was opened to the public on Wednesday), is providing a natural collateral to its propaganda work in other directions.

The electrical section represents a combination of the whole of the organised part of our industry to afford architects, builders, and the general public a comprehensive and educational display of electrical material and apparatus, systems of installation, and opportunities to study their applications by practical demonstrations of the latest practice in lighting, heating, cooking, ventilating, refrigerating, and in the use of electric power. Officers of the E.D.A. will be in attendance.

Working Exhibits

Beginning at the entry of the supply mains, the model substation on the lower ground floor (east end) provides an example of the transforming apparatus and switchgear, and the amount of accommodation required for a building in which about 150 kW of apparatus, twenty miles of cable, and four miles of conduit are installed. The main control switchroom houses an industrial-type switchboard with 300-A three-pole draw-out type main breakers. On each of the three floors there are two switchrooms for the control of the distribution of each section. Pilot lights are provided throughout the building. At the west end of the same floor a General Post Office exhibit demonstrating telephone installation systems by means of cartoons and diagrams, and some all-electric bathrooms. The latter were not quite complete at the time of our visit earlier in the week, but the installation was advanced enough to show the arrangements being made for immediately available hot water service with automatic control.

One of the most striking things on the lower ground and ground floors are the glazed and illuminated cable and inspection boxes; the one on the ground floor extends from floor to ceiling on the south wall near the entrance showing the rising mains for supplying electricity to the floor above.

The Lighting

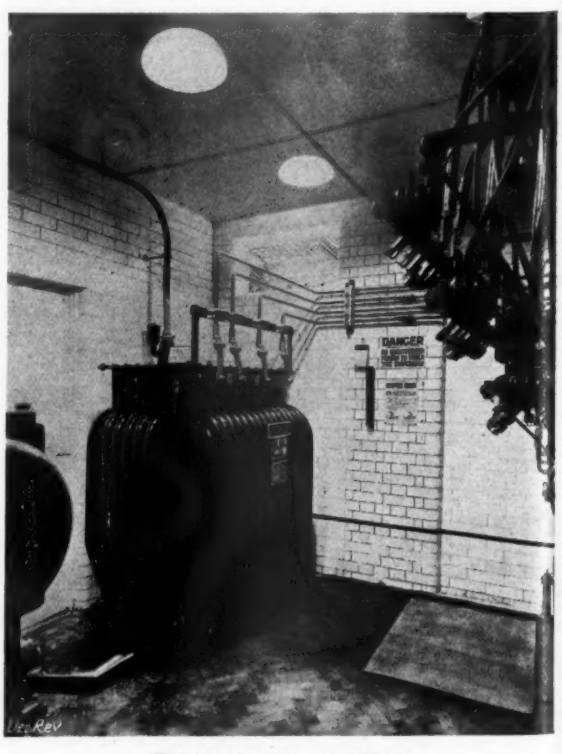
Overhead on the ground floor is to be seen the first installation of its kind in Great Britain of the system of indoor lighting known as the " sunlight tube "—a gasfilled tube which gives a natural lighting and almost shadowless effect. The whole of the central corridor is illuminated by a system of concealed built-in lighting.

The diverse systems of lighting and the great variety of fittings employed throughout the Building Centre are intended to assist architects and others in their choice of equipment for any class of building; the fittings on the staircase should not be overlooked. At the extreme end of the corridor are three all-electric kitchens and an electric scullery containing modern electric cookers, water heaters, washing machines, wash boilers, ironers, and other domestic appliances.

The Electrical Section

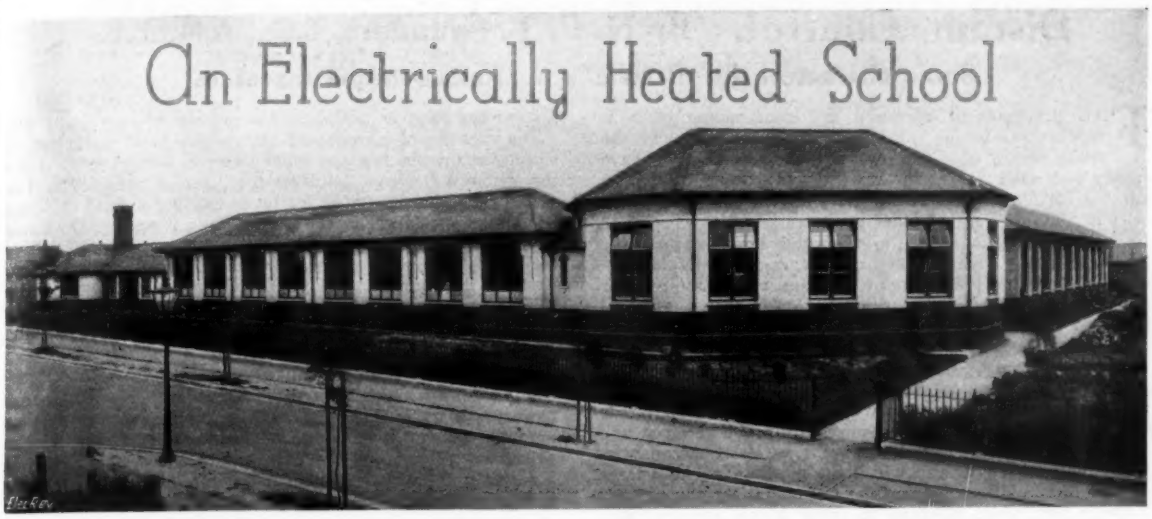
The electrical section proper is on the first floor and arrangements are being made to include the following:—(a) A practical and working exhibit of various systems of electrical cables, conduits and accessories. Examination of the diagrams at present displayed on the site emphasises the educational value of this exhibit to everyone interested in building construction; (b) a home solarium, demonstrating various types of artificial sunlight lamps for home use; (c) a comprehensive exhibit of electric heating methods, including low and high-temperature panel heaters, tubular heaters, heat accumulator convectors, and various types of portable electric fires; (d) hospital electrical equipment; (e) electric lift schemes; (f) lighting fittings designs; (g) a photo-electric cell demonstration, and (h) luminous signalling systems.

This summary of exhibits by no means covers all the electrical features throughout the building. The electrical section when complete will deal comprehensively with electrical wiring installation methods and domestic applications, domestic business, industrial lighting, &c.; industrial applications will also be both permanently and occasionally demonstrated.



The transformer sub-station

An Electrically Heated School



Satisfactory cost comparisons with other heating systems

LINCOLN Education Committee has equipped its three newest schools each with a different type of heating installation. The three buildings are precisely the same in size and construction, although the electrically heated school is situated on a more exposed site than the others.

This school, St. Giles's, is built on the modern "open-air" style, and forms two sides of a square, i.e., the south and east sides, with the assembly hall at the junction of the two wings facing south-east. The south and east sides of the classrooms are exposed to the outside atmosphere, but on the north and west sides the rooms open into a corridor, the walls of which are constructed chiefly of glass, with double doors opening to the outside.

"Unity" tubular electric heaters are employed throughout and are thermostatically controlled. The four classrooms facing south each have a loading of 8.26 kW, whereas the three similar classrooms facing east each have a loading of 8.94 kW. The 7-ft. heaters under the windows at high level are loaded at 80 W per foot on the north side and at 60 W per foot on the west side. The tubes on the east and south walls are placed at low levels and are loaded at 60 W per foot. Three 15-A thermostats set at 60 deg. F. control the equipment in each classroom.

The assembly hall has a total loading of 18.06 kW, the equipment being controlled by a thermostat set at 55 deg. F. and operating a 50-A t.p. contactor. In the cloak rooms the tubes placed under the racks are loaded at 25 W per foot, and one tube over the lavatory basins is loaded at 80 W per foot for frost prevention. Thermostats in the cloak rooms and lavatories are set at 35 deg. F. Hot water is provided by an 11-gallon thermostatically controlled storage heater in each cloak room, and similar heaters of 1½ gallon capacity are placed in the cleaners' room and clinic. In these rooms heaters at 80 W per foot, controlled by thermostats set at 35 deg. F., are also provided to prevent water freezing in the pipes. In the staff rooms and clinic the tubular heaters are supplementary, for draught prevention, to 2-kW fires.

A corner classroom showing tubes on north and east sides

Time-switch Control

The total loading of the installation is 131 kW, and the whole is controlled by a Venner time switch. The school has been built to accommodate 340 pupils, the total cubic capacity being 85,650 ft. and the total floor area 8,650 sq. ft. Electricity is supplied by the Lincoln Corporation electricity undertaking, whose helpful attitude towards this class of heating load has naturally been of the greatest assistance, at ¾d. per kWh, and the consumption for the heating season 1930-31 was 69,000 kWh.

The capital cost of the electrical apparatus, exclusive of wiring and erection, was £522, and the capital cost of the competitive coke-fired boiler scheme, exclusive of boiler house and all building work, was £850. The tender was accepted on the understanding that British materials were to be used throughout, and that the annual consumption was guaranteed not to exceed 72,000 kWh.

The second school is heated by hot water from a low-pressure coke-fired boiler, with the usual types of pipes and radiators, and the circulation is natural. Hot-water panel heating from a gas-fired boiler, with thermostatically controlled natural water circulation, is employed for the third school.

The Education Committee is well satisfied with the results in each school, and adequate temperatures are easily maintained in each case. The "fuel" costs are: electricity, 0.55d. per kWh; coke, 28s. per ton; and gas, 2s. per 1,000 cu. ft.

Comparing the costs of the installations on a basis of pence per cu. ft. of space heated, the cost of the electrical installation works out at 1.81d., that of the coke-fired installation at 1.79d., and 2.20d. for the gas-fired equipment.

The bare annual costs of "fuel" per cu. ft. of space heated are: electricity, 0.304d.; coke, 0.161d.; and gas, 0.220d. To arrive at the true annual operating costs, however, allowances must be made for caretaker's wages, maintenance, and interest on capital.

The saving on the caretaker's wages in the case of the electrically heated school amounts to 0.074d. per cu. ft. per annum, whilst the saving on the same account with the gas-fired installation amounts to 0.051d. per cu. ft. per annum. The cost of maintenance for the electrically heated school amounts to 2 per cent. per annum, or 0.036d. per cu. ft. per annum, while for the coke-fired and gas-fired installations maintenance is taken at 5 per cent. per annum, resulting in 0.089d. and 0.11d. per cu. ft. per annum, respectively.

Loan Interest Charges

Interest on capital under the system of loan adopted by the Ministry of Health is 9 per cent. per annum. The interest on the "Unity" system therefore works out at 0.162d. per cu. ft. per annum, on the coke-fired installation at 0.161d. per

Distant Control. By N. F. T. Saunders, B.Sc., A.M.I.E.E.

Some characteristics of twin synchronous-torque machines

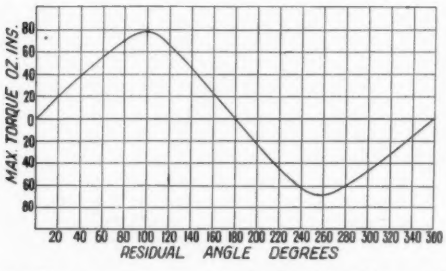
THE principles of operation and construction of twin synchronous-torque machines, better known under the trade names of "Twyntorq" and "Selsyn," have already been dealt with in the ELECTRICAL REVIEW,* but I hope that the further characteristics described in this article will assist in the discovery of other applications.

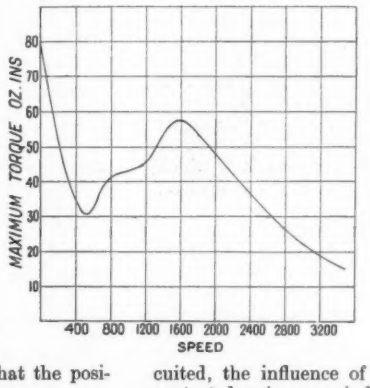
The first essential point is that the torque which the "receiver" will give depends on the relative angular displacement between the two rotors. If the shaft of the receiver is held stationary by means of a torque arm then the torque measured will increase as the rotor of the transmitter is turned up to a maximum of approximately 100 deg.

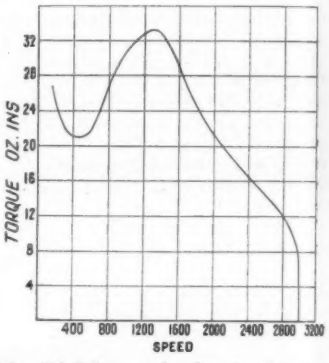
The importance of this "residual" angle depends on the application under consideration. The receiver will follow the transmitter in exact synchronism once this angle has appeared; any variation of the torque required from the receiver will cause a corresponding variation in this angle. Consequently, if the application is one in which the machines make a large number of revolutions for one cycle of operations the residual angle is negligible, whereas in cases where the machines rotate only a few revolutions the angle is important.

From the accompanying torque curve it will be seen that the torque becomes zero when the residual angle is 180 deg. At this point a displacement in either direction results in a torque tending to move the rotor in that direction, so that the position is unstable.

Left: Variation of torque with residual angle. Centre: Speed-torque curve with concentrated winding. Right: Speed-torque curve with secondary terminals short-circuited







If, while the transmitter is being rotated, the receiver drops out of step, it will not come to rest, but will oscillate through something less than the residual angle. The rate of oscillation is proportional to the speed of the transmitter, and the intensity of the vibration set up is inversely proportional to the angle of oscillation. That is to say, the oscillating torque increases as the angle is reduced, and, if the apparatus to which the receiver is connected has a high inertia, damage may result due to the damping effect. If the coupling is arranged to allow a free movement through the residual angle, no trouble is experienced.

Torque and Speed

The maximum torque which the receiver will give depends not only on the magnitude of the residual angle, but also on the speed at which the machines are rotating. In theory the torque is a maximum at standstill, and falls away as the speed of the machines approaches synchronism. In practice, in the case of machines having a concentrated primary winding (*e.g.*, salient poles each embraced by a single coil) the maximum torque varies with speed as shown in the speed-torque curve shown. A pronounced dip appears, so that the torque is a maximum at standstill, falls to a minimum at something less than one-third synchronous speed, and rises to a second maximum at a point an equal amount above one-third speed; *i.e.*, a third harmonic is added to the fundamental curve.

When the machines are at some speed greater than that at which this minimum torque occurs, it is important that the load torque should not exceed the value at the bottom of the dip, or the receiver will drop out of step when starting up.

The variation of current with the residual angle is important, since care must be taken to avoid excessive voltage drop. When the distance between the two machines is very great, the drop may be compensated for by connecting a third machine in parallel with the receiver and allowing it to run idle. Since the current is very largely magnetising current an alternative method is to connect three condensers across the secondary, close to the receiver. Where long-distance leads convey the primary supply to the receiver (or transmitter) a condenser may be connected across the primary terminals of the machine in order to minimise the voltage drop.

Application as a Motor

A possibility which does not yet appear to have been explored is that of using the receiver (or the transmitter) as a motor as well as a synchronous-torque machine. If the secondary terminals of one of these machines are shorted, it becomes a single-phase motor, and owing to the comparatively high resistance of the secondary the maximum torque occurs at a low speed. Consequently, it is only necessary to supply an initial turning movement giving the rotor a few revolutions per minute to obtain a very good torque. In the third figure, showing the speed-torque curve of a machine running as a motor with its secondary terminals short-circuited, the influence of the third harmonic, due to the concentrated primary winding, is evident. The dip is reduced on a machine having a distributed primary winding and may be eliminated completely by pitching the stator coils exactly two-thirds of a pole pitch.

Phasing-in Alternators

Advantages may be taken of the motoring properties of these machines when both inching and running are required. For instance, a pair of these machines might be used for the speeder gear of a turbo-alternator. The transmitter would be mounted behind the control panel and geared to a handwheel, and the receiver connected to the speeder gear in the usual manner, permitting very fine adjustment by the handwheel.

Having used the handwheel for phasing in, the operator would open the valve by shorting the secondary, thus causing the receiver to run as a motor. In order to supply the initial torque it would be necessary either to spin the handwheel while closing the switch, or, alternatively, a starting winding could be put on the receiver which would be switched on to the mains when the secondary was shorted.

The switch should be so arranged as to open-circuit the transmitter secondary at the instant when it short-circuits the receiver secondary. To stop the receiver the short-circuiting switch is opened, but the secondary of the primary must not be reconnected to the secondary of the transmitter until the machine has come to rest, otherwise the transmitter rotor will vibrate as already described. Provided adequate provision is made for damping this vibration, the two secondaries may be reconnected before the receiver comes to rest. In this case a braking torque is exerted depending on the degree of damping.

* "Remote Indication and Control," April 15th, 1932 (p. 558).

An Electrically Heated School (*concluded from page 349*)

cu. ft. per annum, and on the gas-fired equipment at 0.198d. per cu. ft. per annum.

Referring now to the actual fuel costs per cu. ft. per annum, it is necessary to deduct from the electrical and gas figures the allowances for the caretaker, and to add to all three the necessary allowances for maintenance and interest on capital. The net results, therefore, are: electrically heated school, 0.428d. per cu. ft. per annum; coke-heated school, 0.411d. per cu. ft. per annum; gas-heated school, 0.477d. per cu. ft. per annum. These figures are very satisfactory testimony to electrical heating, especially in view of the fact that the electrically heated school is more exposed than the other two, and that the running costs must therefore be relatively higher on account of the increased heat losses.

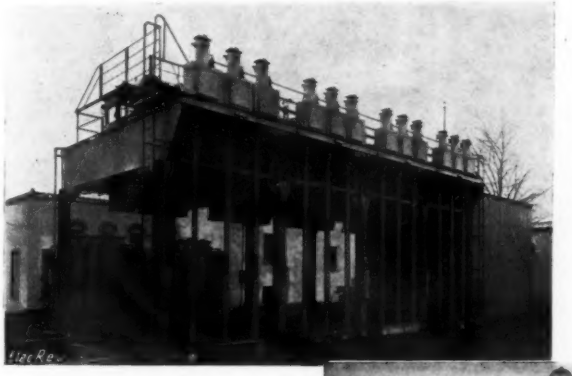
Messrs. Barker, Young & Co., Ltd., were responsible for the design of the electrical heating installation and for the provision of the heating apparatus and thermostatic control gear which we have described.

Metal-clad Switchgear. By A. M. Spruce, A.M.I.E.E.

Its adaptation to outdoor sub-stations

THE introduction and development of metal-clad switchgear is entirely due to British engineers. Two of the earliest installations for power station use date from 1909, when units having duplicate bus-bars and horizontal oil switch isolation were supplied to Stepney and Sheffield. The three phases were situated in the same chambers, but a few years later phase separation came with increased station capacities and system voltages resulting in oil circuit breakers made up of single-phase units, with the bus-bars, connections, and single-phase potential and current transformers mounted in separate-phase earthed-metal enclosures, giving greater security to the operating personnel and to the system. The first designs of this character were made in 1917 for Dalmarnock and Carville.

During the past eight years the metal-clad methods of power control have gained favour with the larger manufacturers both on the Continent and in the United States, who in some instances manufacture under licence from, or in collaboration with, switchgear manufacturers in this country.



It is now possible to obtain any desirable rupturing capacity up to 2,500,000 kVA for almost any system voltage, and the overall time of operation from the instant of short circuit to complete isolation can be reduced to approximately six cycles. To obtain this high speed, sensitive relays are used which operate in about one cycle, and numerous tests have shown that the arcing time in breakers may be reduced to one or two cycles, the remaining time being used in overcoming the inherent time lag of current transformers and other auxiliaries.

In recent years metal-clad switchgear has been adapted to outdoor use following the general tendency with regard to other electrical apparatus.

Economy in Assembly

The factory costs of this switchgear are higher than that of the ordinary outdoor type, or similar duty indoor gear, but great economies can be realised in the field assembly, as units may be completely erected at the manufacturer's works and despatched to site already filled with oil. The only limiting feature of transporting complete units from factory to site is the present railway or road clearance. The limit has already been reached in the United States, when the extension outdoor units were transported to the State Line generating station. On site, the main work consists of securing the units to a previously erected steel structure, raising oil circuit breakers into position by means of an elevating truck, making pipe flange joints and copper connections between adjacent units, and completing the incoming and outgoing cables. The design of outdoor metal-clad gear permits a more speedy replacement of breakers than with open-type switchgear. Where there is insufficient room in an adjacent building to carry out oil-switch or other repairs, a special sheet-metal house is usually built at one end of the structure, forming an integral part of it, as in the sub-station illustrated. Access doors are fitted at each end of the house, and the oil breakers for repair can be run directly into it on a transfer truck.

Inherent Characteristics

Metal-clad switchgear is inherently more suited to outdoor operation than the open type, as all conductors and insulators are completely enclosed, and the trouble resulting from dirt or salt deposits is eliminated. Its chief advantages may be summarised as follows:—1. Compactness; 2. Enclosure of live parts; 3. Reduction in cleaning and maintenance costs; 4. Easy and efficient interlocks; 5. High degree of insulation with phase isolation; 6. Easy removal of breakers and potential transformers; 7. Decreased fire risk and less damage from bursting tanks, with easily arranged drainage for burning oil; 8. Less engineering and layout work; 9. Easy extension and high salvage value; 10. Freedom from contact between live metal and external objects; 11. Use of a durable and easily maintained fabricated-steel supporting structure.

Use on Large Systems

In March, 1928, the first 33-kV installation with duplicate oil circuit breakers (rated at one million kVA) was placed in commission at the Wheaton sub-station of the Public Service Co. of Northern Illinois, which serves some half-million consumers in 320 communities, and farming and manufacturing centres in an area of about 600 sq. miles. Many similar equipments have been added subsequently to the company's distribution network.

The experience of this company regarding the cost of outdoor metal-clad equipment, in comparison with the open type, appears to be in favour of the former. This is confirmed by the majority of other operating companies having similar gear. In a few cases, the cost of outdoor switchgear, compared with indoor isolated-phase cell structures, has been considerably lower due to the elimination of large buildings, but the overall cost will, to a certain extent, be governed by site conditions and transport facilities.

The chief difference in the designs of the Wheaton sub-station and a later sub-station at Wilmette is in the layout of the bus-bars, which affects the ground space occupied. At the former, the three phases are placed side by side, and at Wilmette above each other. The oil switch tanks at each station are approximately of the same diameter, but with the later layout the width of the units between column centres was reduced from 23 ft. to 15 ft. 10 in., with very little difference in height. For use in congested and important distributing areas, this type of switchgear will usually be found economical.

At Waukegan, the fifth generator of 115,000-kW capacity and its main power transformer (120,000 kVA, 18 kV/132 kV) operate as one unit, being directly connected together with p.i.l.c. cables, and switching is at the higher voltage, no low voltage bus-bars being used. For generator protection, differential relays are supplied which trip the alternator field switch, its 132-kV outdoor circuit breakers, and the breakers in series with a 10,000-kVA auxiliary transformer tapped from the main circuit.

Top: Cable entry to 33-kV switchgear at Wilmette sub-station
Centre: Wheaton 33-kV sub-station with 600-A metal-clad switchgear
Bottom: Metal-clad switchgear at Wilmette sub-station

The bus-bars of the outdoor metal-clad equipment are rated at 1,200 A and have a cross-sectional area of 2.4 sq. in. in the form of oil-filled cable weighing about 28 lb. per ft. run. The interconnections also consist of oil-filled cables, and are supplied complete with all the necessary end bushings, pressure tanks, and steel supporting frames. This was the first 132-kV outdoor metal-clad switchgear to be placed into operation.

The largest single installation of this kind of gear is in commission at the State Line generating station, Indiana, U.S.A. The initial switches at this station control the output

of a three-machine unit, comprising one 76,000-kW generator and two 62,000-kW generators (at 0.85 power factor), with two 4,000-kW auxiliary generators connected to the low-pressure turbines.

A 22-kV Installation

This station is unique, as the complete switching equipment is situated out of doors, with the generators feeding directly on to the bars at 22 kV. A duplicate closed-ring bus-bar divided into three sections is employed, one generator supplying each section, but connected to the bars 120 degrees apart, in order to limit the short-circuit energy and obtain a better balance of bus-bar currents with as little current disturbance as possible when a machine is connected to or disconnected from the bars. Reactors will be placed between each future generator unit on the bars, and the short-circuit kVA after installing the second unit will not greatly exceed 2,000,000 kVA irrespective of the number of generators added.

Switchgear (22 kV) at State Line generating station

The generator breakers are rated at 2,000,000 kVA, 22 kV, 3,000 A. Energy is distributed to the various centres at 33 kV and 66 kV by means of underground cables, and at 132 kV by overhead lines. With outdoor metal-clad switchgear, it is usual to connect up externally by means of cables, and it would appear that where open-type gear is introduced into the circuit, as at State Line, the advantage of totally enclosed connections is, to a certain extent, lost. More security can be obtained by phase clearances on the open gear increasing.

At State Line seventeen extension bays have recently been added, similar in layout to the original units, but of more compact design. The breaking capacity of the later switches has been increased to 2,500,000 kVA at 25 kV, and are probably the first breakers with this capacity to operate on a relatively low-voltage system; during the tests at the manufacturer's works they successfully withstood a short-circuit current of 145,000 A.

In England, 33-kV outdoor metal-clad oil-filled switchgear has been installed at the Brimsdown station of the North Metropolitan E.P.S. Co. At the Spondon station of the Derby & Notts Power Co. the same type of gear (but with single oil breakers) is connected to the low-voltage side of the power transformers at the 132-kV grid station.

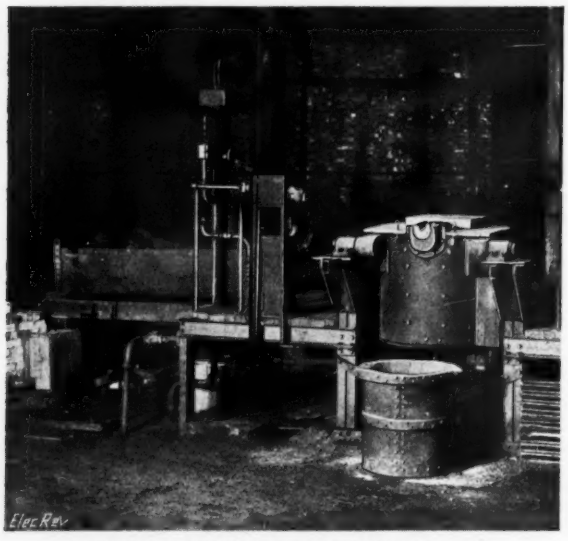
High-frequency Electric Steel Furnaces

STEEL experts from various parts of the country recently paid a visit to Newcastle to see a demonstration of steel melting by means of the "Witton" high-frequency induction furnace made by the General Electric Co., Ltd.

This type of furnace differs in design and construction from all other high-frequency furnaces, and its comparatively low current consumption per unit of output is attributable to the fact that it is partially cored.

The high-frequency furnace is essentially a quick melting unit, and is more suitable for intermittent use than other types. Its thermal efficiency is remarkably high and the current consumption per unit of output is less than that of the arc furnace. Based upon average rates for electricity in industrial districts, for instance, the company claims that steel, superior in quality to the best crucible steel, is produced at approximately half the cost of the crucible process. Labour requirements are reduced to the minimum; automatic control simplifies the operation and is recommended. Rapid melting has an important economic value, as it renders a furnace of small unit capacity capable of a comparatively large output.

The path of the magnetic field in the "Witton" furnace is through thin laminations of special alloy steel which has a conductivity for magnet flux several thousand times that of the air path of other furnaces. This alloy steel path is brought to a central position right inside the axis of the inductor coil.



A "Witton" high-frequency induction furnace

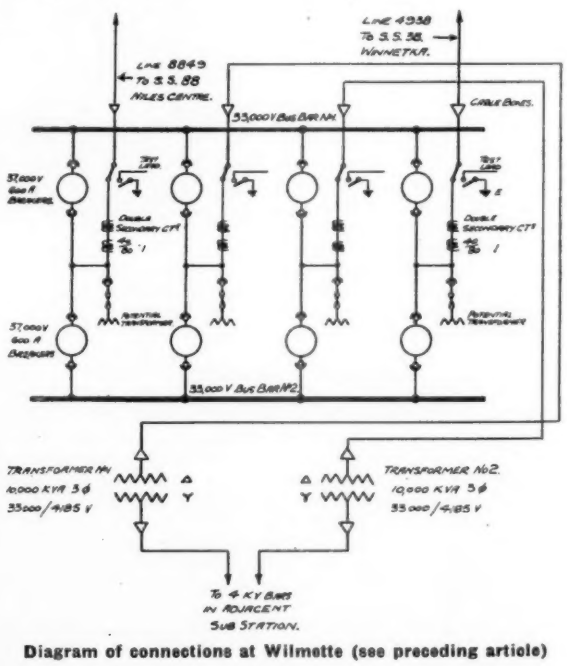


Diagram of connections at Wilmette (see preceding article)

The result is that, instead of creating a magnetic field weakened by air resistances and uncontrolled as regards its distribution within the crucible, the electro-magnetic system furnishes an intensely strong and centrally situated magnetic field inside the crucible for the more economic melting of the charge. Consequently, the rest of the electrical equipment can be made entirely subservient to the safety of the operators and plant. It is, also, the presence of this alloy-steel container and core which permits iron and steel to be used throughout to encase the furnace. In addition, stray magnetic fields outside the inductor coil are reduced by it.

A.C. Testing Circuits. By J. L. Ferns, B.Sc.(Hons.)

Their design as affected by phase angles and harmonics

IT is more difficult to design a.c. than d.c. testing circuits because they include iron-cored transformers or choke coils.

Curve 1, fig. 1, gives the B/H curve for a type of iron in common use for transformer laminations, which shows that if the magnetising force alternates, then the flux cannot alternate with the same wave form. It is only when transformers have non-magnetic cores or iron cores with an appreciable air gap that the flux has the same wave shape as the alternating magnetising current; this is because the permeability of non-magnetic material is constant at unity (see fig. 1, curve 2).

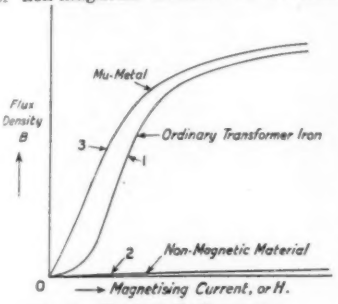


Fig. 1.—Typical B/H curves

Wave Forms

Discrepancies between the flux and magnetising current wave shapes vary with the maximum value attained by the current, owing to the effect of the saturation point on the flux, and fig. 2 shows the wave form of magnetising current for four different values of maximum voltage in the same transformer, the voltage wave being sinusoidal. To obtain these waves the hysteresis loops for the values concerned must be used and not the B/H curve in fig. 1. When a voltage transformer is loaded the load current usually masks the harmonics in the magnetising current.

The wave shape of the flux resulting from supplying a transformer primary, or closed iron-cored choke, with a sinusoidal magnetising current is shown for four different maximum current values in fig. 3. As the secondary e.m.f. has the same wave shape as the rate of change of flux, the secondary voltage will have the wave shape shown in fig. 4. The importance of the harmonics rises with increase in the flux density of the core. As the magnetising current of a current transformer is usually sinusoidal, an ordinary c.t. should be worked at very low flux densities. If mu-metal is used for the transformer core much higher flux densities may be employed without distorting the wave shape (c.f. B/H curves 1 and 3 in fig. 1). As the flux density in the core of c.t.s. rises with increase in the secondary burden, the liability to set up harmonics is intimately associated with the secondary burden.

Current and Voltage Transformers

If a transformer primary is in series with a relatively high impedance (which does not involve the magnetisation of iron) then the current in the circuit will be sinusoidal if the primary voltage is sinusoidal. Consequently the transformer will act like a current transformer, and the wave shape of the secondary voltage will depend on the maximum value of the flux density, as shown by fig. 4; this is important because certain testing circuits employ a variable resistance in series with the transformer primary in order to control the secondary voltage. It therefore depends on the maximum flux density in the core whether the output will be satisfactory for testing purposes. Another instance where resistance is sometimes employed in the primary of a transformer is the phase-shifting device shown in fig. 5. The point where the introduction of impedance in the primary of a transformer begins to affect the output wave shape is difficult to determine, and in practice it is best to design the circuit so that this factor does not enter into consideration, and load should be regulated by a variable impedance in the secondary or by tappings on the primary or secondary winding.

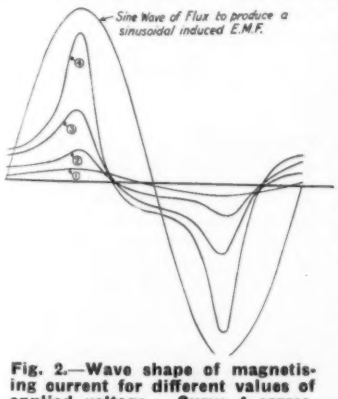
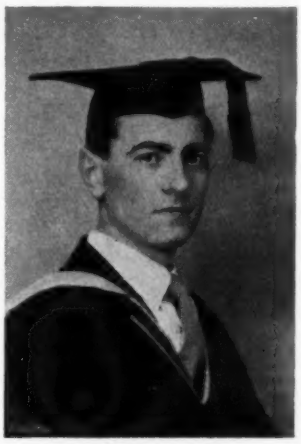


Fig. 2.—Wave shape of magnetising current for different values of applied voltage. Curve 4 corresponds to the highest voltage

When the load on a current supply transformer is regulated by a variable impedance (usually a bank of rheostats), a high resistance is in circuit at low loads in order to keep the current low. When heavy currents are required, the combined resistance of the rheostats falls (in the majority of testing circuits of this type) practically to zero, since the impedance of the apparatus under test plus that of the measuring instruments is sufficient to keep the current down to the required value. Current supply transformers are often designed so that the output voltage is only sufficient to drive the highest current through an impedance comprising the apparatus under test, the measuring instruments, the impedance of the transformer secondary, and the resistance of the conductors and joints.



Mr. J. L. Ferns is a testing assistant in the Manchester Corporation Electricity Department

Sinusoidal Wave Shapes

With low currents the high resistance load ensures that the wave shape of the current is sinusoidal if the output voltage wave is sinusoidal, but with heavy currents the character of the load may be quite different. If the apparatus under test and the testing instruments present a highly inductive load then the secondary load will be inductive, and its resistance of minor importance. If the inductance is due to flux in non-magnetic media then the load current will remain sinusoidal, but if it is due to flux in magnetic media then the wave shape will depend on the maximum flux density reached in the various parts of the load, as shown in fig. 2. The same condition arises with low currents, if the inductance (due to iron) in the secondary circuit necessitates the rheostat bank having practically zero resistance in order to obtain the desired current.

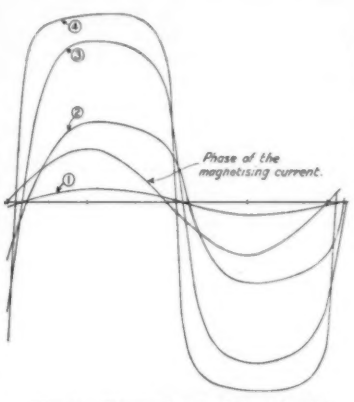


Fig. 3.—Wave shape of flux for different values of sinusoidal magnetising current

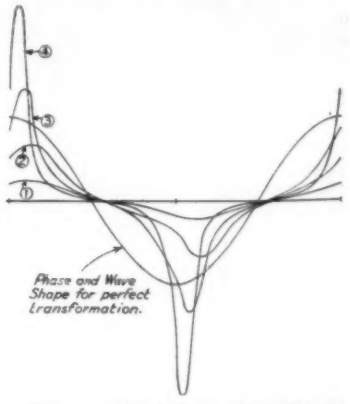


Fig. 4.—Wave shape of induced e.m.f. corresponding to curves in fig. 3

Thus it is not always sufficient to provide a supply transformer giving a sinusoidal output, if a sinusoidal current is desired in the apparatus under test; consideration must also be given to the time constant of the secondary load. Where the inductance is caused by iron the supply voltage must be high enough to require appreciable resistance in the secondary circuit at all loads. This entails a bulkier resistance bank and a greater power demand, but the expense is well merited. The precautions regarding the time-constant of the load also apply to the variable-tapping type of current supply transformer.

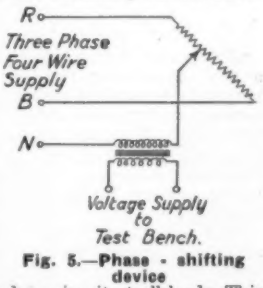


Fig. 5.—Phase - shifting device

Objections to Harmonics

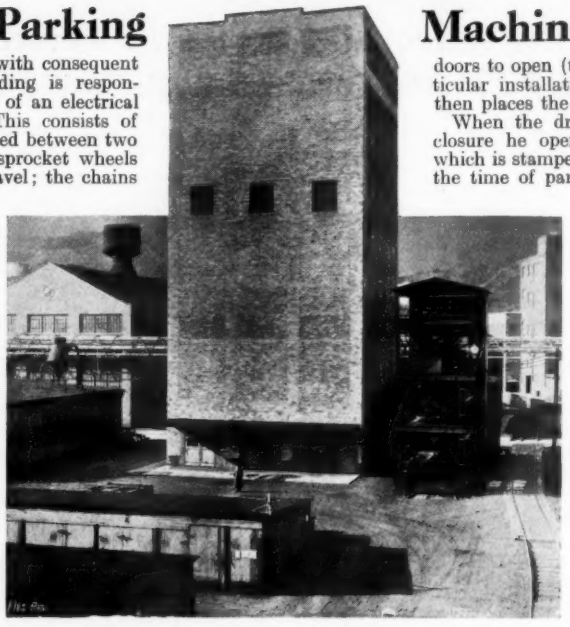
In the commonest form of current supply circuit (*i.e.*, that for supplying the phantom load in meter testing equipments) if the voltage supply is sinusoidal, the harmonics will not affect a wattmeter, but they will cause a motor-type watthour meter to slow down. The decrease in speed is due to the increase in the series coil flux causing its braking effect to increase. The percentage effect of the harmonics will, of course, be small provided the series flux is small relative to the

An Electrical Parking Machine. By G. S. Mitchell

THE growth of large cities with consequent congestion and overcrowding is responsible for the development of an electrical vertical car-parking machine. This consists of cradles, one for each car, supported between two endless chains which pass over sprocket wheels at the top and the bottom of travel; the chains are driven by two electric motors, and by means of push-button control (or its equivalent) any cradle can be brought quickly to the driveway level for receiving or discharging an automobile.

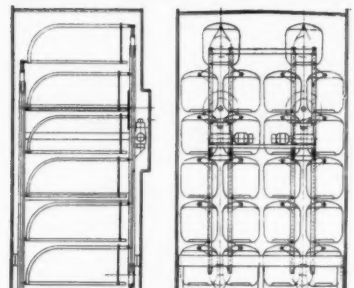
The Westinghouse Electric and Manufacturing Company, of East Pittsburgh, Pennsylvania, U.S.A., is responsible for the development of the machine, which is actuated by the pressing of a button, insertion of a key, or deposition of a coin, depending upon the type of control system installed.

Outside the garage is a panel having several numbered locks, one for each parking space. Each tenant is provided with a key, which, when inserted in the lock for his particular space and turned at right angles, dispatches that cradle to the driveway and permits the tenant's taking his key from that lock and inserting it in the door lock. When the key in the door lock is turned ninety degrees sideways, it establishes a circuit which automatically opens the door as soon as the cage is level with the driveway.



A Westinghouse vertical parking machine

While the driver is engaged in driving his car "on" or "off" the key remains in the door lock, preventing anyone else from operating the machine while the driver is inside the enclosure. When the automobile has been driven in or out, and the tenant is ready to leave, the key is turned to the vertical position in order to remove it from the lock. This, by establishing another circuit, closes the doors, leaving the machine ready for use by the next tenant.



Cross sections of a twelve-car parking machine

Push Button Operation

This method is especially suitable for use in a public garage, where the push-button can be situated in the cashier's office. When a customer wishes to park an automobile, a dispatcher directs him to a vacant place and opens the door to the parking space, or the customer drives close to the opening of a machine showing a "vacant" signal, where a light-ray-operated relay or a track switch causes the doors to open (the system best suited to the particular installation may be selected); the driver then places the automobile on the cradle.

When the driver has stepped out of the enclosure he operates a lever to get his check, which is stamped with the location of the car and the time of parking. The lever also establishes circuits for closing the door and dispatching an empty cage to the driveway level, ready to receive the next automobile.

When the driver returns for his car he presents the check to the cashier, who pushes the button corresponding to the check and receives payment for the storage. By the time the driver reaches the machine his car is at the ground level and the doors are open ready for him to drive out. In driving off the cradle a circuit is established for closing the doors.

A third method is similar, except that a coin machine is used instead of push-buttons. If the driver overstays his time (should there be a time limit) he is required to deposit additional money.

Time Saving

The average time for parking a car, or delivering it, is approximately one minute. Electric motors operate the machine at a chain speed of 100 ft. per minute, so that the average time for bringing a cage to the driveway level is 30 secs.; when a cage is called to the ground level the machine automatically selects the shortest route. Another thirty seconds is consumed in driving the automobile in or out and in operating the doors.

Persons entering or leaving the automobile must stand on a platform and thus, by opening a contact, prevent the doors being closed as long as anyone is within the enclosure.

Each machine of twenty-four parking spaces is 105 ft. high, and occupies a ground area of 16 ft. by 24 ft. for automobiles 18 ft. long. When several machines are installed most of them can be made for shorter automobiles, thus reducing the required ground area and the first cost. For each pair of cradles omitted or added the structure is changed 8 ft. in height. The machine may be arranged for loading and unloading at either the bottom or the top of the loop.

The car is placed on and taken off the machine by the driver himself, and no attendant need handle the car. After the car has been placed on the machine there is no danger of its being bumped or injured, and no one has access to the car except in the presence of the driver, which prevents tampering and the removing of anything from it.

The car is not operated under its own power after it is placed on the machine, a fact materially decreasing the fire hazard and eliminating ventilation problems.

Attendantless operation by using a coin-collecting machine makes the cost of operation very low; dual drive assures continuity of service. The machine makes only from thirty-five to forty revolutions per day, so that the wear is very small and there is no heating of bearings; the maintenance cost is thus reduced so as to be almost negligible.

A.C. Testing Circuits *(concluded from preceding page)*

brake-magnet flux. A current, or flux, cannot interact with a flux of different frequency to produce a steady driving torque in a wattmeter or a watthour meter, but an a.c. ammeter registers the r.m.s. value of the current, and its deflection will be affected by harmonics according to the law: $I_{rms} = \sqrt{I_f/2 + I_a/2 + I_3/2 + \ldots}$ where I_f = maximum value of fundamental current; I_a = maximum value of the second harmonic current; I_3 = maximum value of the third harmonic current, &c.

Now the correct working power factor in the single-phase apparatus under test, if V is sinusoidal, is given by watts/0.707 V.I_f.

As the quantity measured by an ammeter is I_{rms} it will not be possible, if harmonics are present, to ascertain the correct power factor. In testing many kinds of a.c. meters and instruments a knowledge of the true power factor is of the greatest importance, and therefore harmonics cannot be tolerated if an accurate test is desired.

If harmonics are present in the voltage supply only, the effect on the voltage flux in the apparatus under test, the voltmeter deflection, and the power factor will be similar to that for the current supply.

When both the current and voltage supplies to the apparatus are subject to harmonics, then the conditions become rather complex because it will be possible for harmonics of the same frequency to interact in wattmeters and watthour meters. As the response of a watthour meter to a higher frequency than the fundamental is usually different from that of a wattmeter, errors will be introduced on this account. Also, as the power factor of each harmonic will be different from that of the fundamental, the determination of the testing power factor becomes rather problematical.

The Introduction of Error

Harmonics are also undesirable in the testing of induction relays and ammeters, the response of which to frequencies higher than the fundamental is not the same as that to the fundamental. As the sub-standard indicates the r.m.s. value of the current, harmonics must introduce errors. Many types of induction relay contain a current transformer which on certain loads becomes saturated and to aggravate matters the c.t. supplying the relay is, at this stage, working on heavy burden. The wave shape of the current in the series operating coil of the relay will not be a sine wave, which probably accounts for many of the peculiarities in the operation of inverse time limit, definite-minimum time, induction relays.

Educational

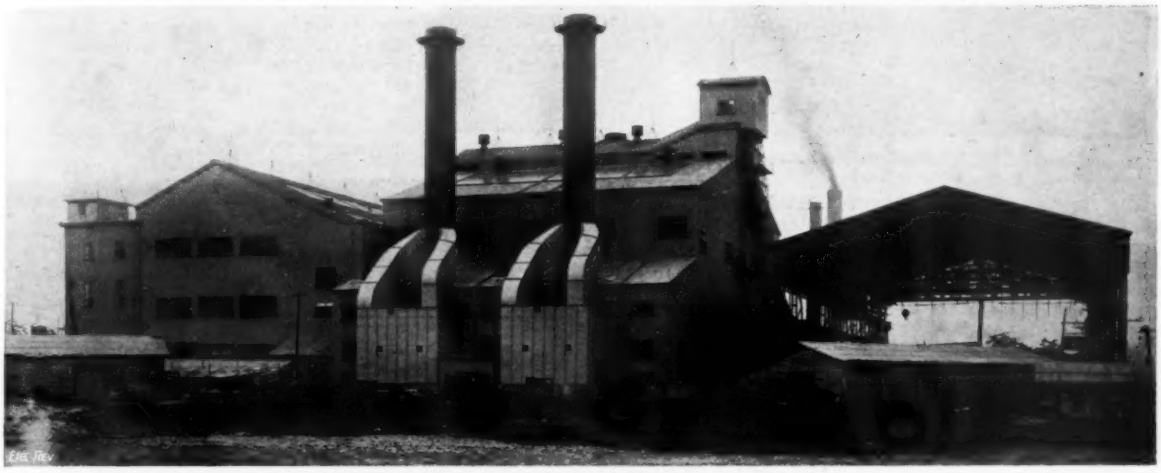
Particulars are given in our advertisement pages to-day of the new courses in electrical engineering, &c., which commence shortly at the Regent Street Polytechnic, W.1, and the Borough Polytechnic, S.E.1. There are also details of engineering scholarships offered by the Northampton Polytechnic Institute.

A New Japanese Power Station

Large high-speed turbo-alternators of British manufacture

THE Kyushu Hydro-electric Railway Co., Ltd., of Japan, not only supplies power and light to the chief industries of northern Kyushu, but is also interested in traction. Its electric lines already connect five towns, and developments are proceeding in connection with fifty additional miles.

The company started operations in 1910 with a small steam station in which B.T.-H., American G.E., and Met.-Vick. turbo-generators were installed from time to time. Its new station, designed by Mr. Y. Hirose, the company's chief engineer, has been built at a much lower total cost than any other in the country, and it is expected to reduce generating costs below anything hitherto accomplished in Japan. The site is on the western seashore of Kokura City, in Kyushu, on land reclaimed by ash disposal from the old station. The concrete foundation raft is supported on piles driven down to the rock, and the steel structures were designed to resist earthquakes. The walls are of corrugated sheet steel, covered with wire netting and plaster.



A general view of the completed power house at Kokura

The proximity of the main railway line facilitates coal transport. Fuel storage and handling equipment was supplied by the Ajikawa Iron Works, comprising wagon puller and tipplers, weighing machine, belt and bucket conveyors, skip hoist, reciprocating and screw feeders, and grab cranes, driven by a.c. 200-V three-phase motors supplied by the Mitsubishi Electric Works. A coal crusher and dryer are also installed.

The Boiler Plant

The four Babcock & Wilcox boilers operate at a steam pressure of 37.5 kg. per sq. cm. and a temperature of 415 deg. C., normally evaporating 73,483 kg. per hour with feed water temperature of 149 deg. C. They are of the c.t.m. vertical header type, with a heating surface of 1,684 sq. m. and a superheating surface of 366 sq. m., the degree of superheat being 149 deg. C.

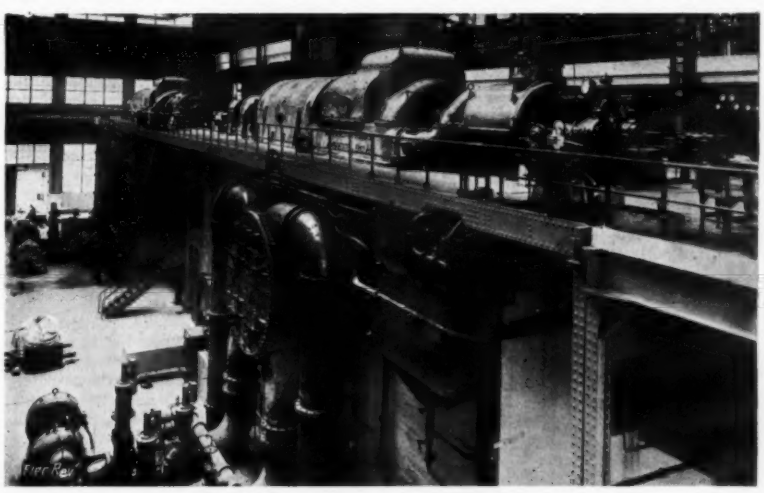
The "Aeolus" 175-h.p. forced and 380-h.p. induced draught fans, made by the Seki Co. (Tokio), are driven by Shibaura 750-360-r.p.m. motors. There are four 387-b.h.p. four-stage centrifugal feed pumps; one is driven by a W. H. Allen & Sons' impulse steam turbine, and three by B.T.-H. 3,300-V three-phase motors. Each boiler is fired direct by its individual self-contained Fuller-Lehigh coal pulveriser, hot air from a B. & W. tubular preheater being induced into the mills to dry the coal. The furnace volume is 361 cu.m., and the Bailey water-cooled wall surface 199.7 sq. m. Each boiler has six "Calumet" turbulent burners, three B. & W. volute blowers, and three ball mills. A 375-W 125-V d.c. magnetic separator is installed.

Ash is removed by the Allen Sherman Hoff process. The molten slag is tapped from the furnaces, broken into fine pieces by strong water jets, and removed by pump sluicing.

The flue gases are cleansed by "Pneuconex" plant. The larger particles of grit are caught in mechanical collectors, while the fine dust and fumes are washed out by high-pressure water sprays. The Bailey system of automatic combustion control has been adopted to ensure that powdered coal and air are mixed in the correct proportions for each boiler according to load variations. The whole of this equipment is electrically controlled, all the indicating instruments being arranged centrally. The operator also has remote control of the boiler auxiliaries in parallel with hand control.

The Turbo-generators

Each of the two steam turbo-generating sets comprises a 25,000-kW main alternator and a 2,000-kW house-service alternator, running at 3,000 r.p.m. (m.c.r.). They are stated to be the largest and highest speed machines installed in Japan so far, and were made by the Metropolitan-Vickers Electrical Co., Ltd. The Rateau-type turbines operate at a steam pressure of 35 kg. per sq. cm., and a temperature of 400 deg. C., exhausting into a vacuum of 28.5 in. Each has twenty h.p., six l.p. impulse, and two multiple exhaust stages. One lubricating pump, a "Vickcen" purifier, and three oil coolers per turbine are provided. The feed-water heaters are of the U-tube surface type with vertical centrifugal motor pumps, and the evaporator is of the M.V. vertical low-pressure type.



The engine room, showing the condenser basement

The surface condensers have Sumitomo tubes; 150-h.p. circulating water and 50-h.p. extraction pumps, driven by 3,300-V three-phase motors, and steam-operated air ejectors with an intercooler. The cooling water screens were made at the Ishikawajima dockyard. For minimising condenser corrosion there is a 220-V three-phase motor-generator set, with a 2-kW d.c. output of 200A at 10 V.

Coupled in line all directly to each turbine are one main (25,000-kW m.c.r. 11,000-V) and one house-service (2,000-kW m.c.r. 3,050-V) 50-cycle, 0.8 p.f., three-phase star alternators

of 12 and 16 per cent. inherent reactance respectively; together with a shunt wound, double armature, common yoke 133-kW 350-V main exciter (which is, in turn, excited by a 0.91-kW

The boiler house control floor

360-V magnet excited machine connected by 3,000-1,260 r.p.m. gear to the main alternator) and a self-exciting 24-kW 130-V house-service set exciter.

Water-cooled air is circulated round the closed ventilating circuit, and fire protection is afforded on the "Alfite" time-delay CO_2 system. A complete Mitsubishi electrical protective system has been provided, with automatic telephones, coloured signal lamps, and alarm devices in the central control room, including temperature indicators for the principal generators, transformers, and motors.

The main generators are connected direct to 10,500-kVA 11/22-kV transformer, single-phase, delta-delta connected. There are seven, three per machine, with one spare. The double bus-bars and switchgear are on the high-voltage side of the transformers. The reinforced concrete cellular construction separates the phases, and non-magnetic barriers minimise stray fields and inductive heating. The main circuit breakers are of the single-pole solenoid-operated compartment type for 1,200 A at 22,000 V, with a breaking capacity of 600,000 kVA. All transformers and switchgear are of Mitsubishi manufacture.

In the event of the supply voltage falling below a predetermined limit the house-service circuit will be automatically changed over from the generators to the transformer bus-bars and thus maintain the auxiliary services.

There is an Ajikawa electric travelling crane and an American Otis lift; Electroflo steam instruments are used, and Kent, Negretti, Siemens, Kelvin, Cambridge, and Bailey boiler instruments have also been installed.

The power generated is transmitted a distance of 400 metres to a sub-station by a double underground circuit of 62,500-kVA capacity with a third spare circuit. The cables operate at 22,000 V and are of the Emanueli oil-filled type, of 322 sq. mm. sectional area, paper insulated, double lead sheathed, reinforced with hard copper tape and jute yarn covered. They are the first of their kind to be used in Japan, and were made by the Sumitomo Co. The cables are laid in a concrete trough, which is filled with pitch to exclude sea water.

A battery of grinders in the boiler house

An All-electric House at Birmingham

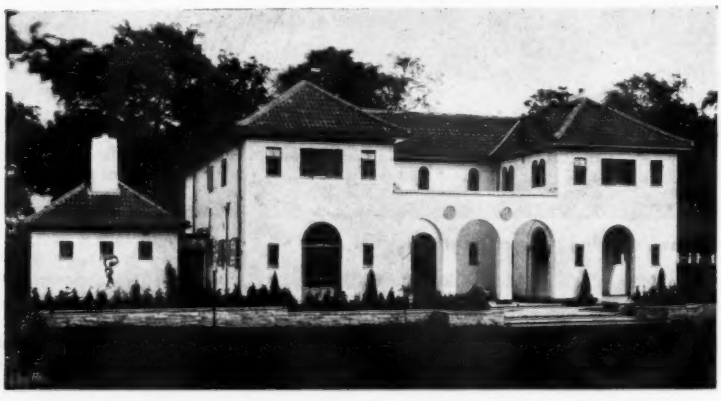
IN Birmingham and the Midlands considerable public interest has been aroused by an all-electric house which has been built by the Birmingham Circle of the British Electrical Development Association in Vicarage Road, Edgbaston, Birmingham, for the purpose of encouraging public interest in electricity in the home. Unlike other houses, it has been designed for the special purpose of taking the fullest possible advantage of the saving in building costs which only a completely all-electric house can achieve.

The formal opening by the Lord Mayor of Birmingham (Ald. J. B. Burman) took place on Wednesday. Comfort and convenience represent the keynote of the house, which is fitted with every appliance calculated to reduce labour and cost to a reasonable minimum. Architects and builders will find much of interest in the special constructional features of the house, admission to which is free.

"There is nothing more difficult than to persuade people that something new is good." With this sentence the Birmingham Circle of B.E.D.A. opens its introduction in an interesting souvenir booklet; it then adds that "everyone engaged in the electrical industry knows that at no very distant date electricity will supplant all other methods of lighting, heating, cooking and power transmission, but progress is retarded by lack of knowledge and appreciation on the part of the public."

A point is made of the fact that the completion of the national grid system for distributing electricity over the whole country, and the reduction of charges for electricity will result in an increased demand, and special effort is made to show the public what is possible on the domestic side. The building has been erected by Messrs. B. Whitehouse & Sons, Ltd., Birmingham, from the design of Mr. N. Norman Twist.

An excellent opportunity is offered to study different types of panel and tubular heating systems. In the lounge and dining room a "Dulrae" system of panels has been installed in the ceiling, the equipment in the grates being for effect only, though heat can be turned on if required. The "Wardle" tubular heating system is employed in the hall and corridors and in the cloakroom. A "Unity" tubular system has been arranged to air and dry clothes and the "Unity" system is also used in several other rooms.



The E.D.A. all-electric house in Vicarage Road, Edgbaston, Birmingham

Water for the kitchen and bathroom is electrically heated and perishable food is preserved in the automatic refrigerator. All the cooking is done electrically.

Indirect lighting is shown to advantage in the lounge and there are plug points round all the rooms for the attachment of various heating and lighting equipment. A feature of the bedrooms is the automatic lighting of wardrobe interiors. The mirrors in the bathroom are electrically lighted, and the towel heater is also electrical, a "Radiant" electric heater being fitted on the ceiling.

The directors of the All-Electric House Co. are Messrs. H. E. Walker (chairman), W. Donovan, E. A. Reynolds, H. H. Mountford, and H. Millinger; with Mr. H. Keeling (secretary). Mr. Walter Donovan is the chairman of the Birmingham Circle of B.E.D.A.

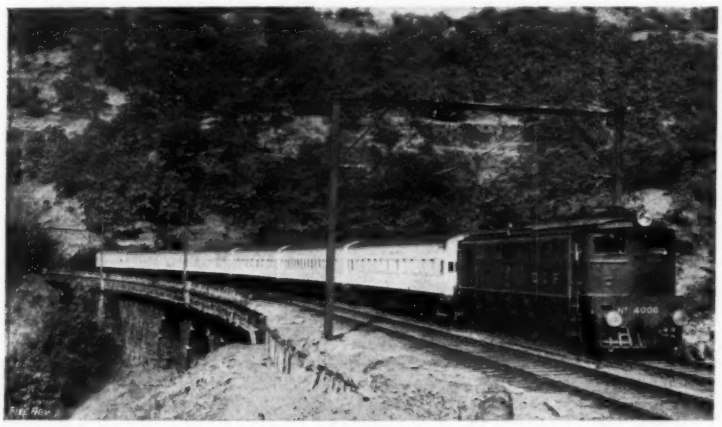
Electrical Matters Discussed at York

Some papers read at the British Association meeting

THE number of people attending the British Association meeting at York was nearly 2,000—lower than the average of recent years, but the programmes of the various sections have been rather above the usual standard, especially so with regard to electrical matters. Seven of the papers presented before Section G (Engineering) dealt directly with electrical subjects, whilst most of the others possessed some indirect electrical interest. Last week we reported several of the addresses and papers, and we complete our report of the meeting below. Next year's meeting is to be held at Leicester from September 6th to 13th.

Railway Traction by Electric Power

IN his paper on this subject, Mr. F. Lydall confines his attention to propulsion by electricity (*a*) transmitted by track conductors and (*b*) derived from a battery. Although the Drumm battery after a 20-minute boosting charge will give an output of 2 Wh per lb. and the charge and discharge cycle can be repeated twenty times a day, the author regards it as unlikely that it will supersede track conductors. For a ten-minute service in both directions on a 20-mile double track, a



An electric train on the Bhore Ghat, G.I.P. Railway

train, weighing without batteries 220 tons and making the single journey in 70 minutes with stops every half mile, would consume about 70 Wh per ton-mile. Batteries, recharged for 20 minutes at the end of the journey, would weigh 100 tons; the energy consumption would be increased by 45 per cent. due to their weight and 20 per cent. due to their relative inefficiency. Two extra trains and accommodation at the terminal stations would be necessary.

If 1½ miles of track conductor were put down at each end to enable the batteries to be charged at the beginning and the end of the single journey as well as during the lie-over period, 80-ton batteries would suffice with an increased energy consumption of 36 plus 17 per cent. No extra trains would be required, but against this would be the cost of the six miles of track conductors. Fuel, wages and locomotive maintenance make up 75 per cent. of the costs of operation that are affected by electrification.

French experience would indicate that one kWh at the sub-station high-voltage terminals would do the same work as 3.85 lb. of coal and that the results on the different electrified lines (averaging about 50 Wh per ton-mile) are fairly consistent.

Coal consumption on six sections of the British railways is compared with estimates of the amount of electricity required, and the conclusion is drawn that with coal at 17s. 6d. per ton and electricity at 0.4d. per kWh delivered to the sub-station there will be a saving if the volume of passenger traffic is small and there is much shunting.

A saving in wages under electrification would be obtained in two ways. The first would be due to the speeding up of traffic (except passenger expresses) and locomotive preparation and cleaning; in a report to the Weir Committee, Messrs. Merz and McLellan showed that on certain sections investigated on the L.N.E.R. a reduction of 20 per cent. could be effected. A second, and greater, saving is obtainable by one-man operation, safety being assured by the dead-man's handle on the master-controller. Present-day steam locomotive maintenance costs vary between 5½d. and 7½d. per locomotive-mile; these include materials, labour, supervision for inspection, cleaning and running and workshop repairs.

There is a much greater variety of electric locomotives in service on the different railways, but the equivalent cost of maintenance should be less than half the cost with steam. On the Glencoe-Maritzburg section of the South African railways the comparative figures are £49,978 (1.88d. per locomotive-mile) and £130,000. On the Great Indian Peninsula Railway the inclusive maintenance cost for the six months ended May, 1932, in pence per mile was as follows: (1) passenger, (2) freight: Workshop repairs, body and mechanical, (1) and (2) 0.67; workshop repairs, electrical (1) 0.183 (2) 0.145; running repairs, body and mechanical (1) 1.01 (2) 2.21; running repairs, electrical (1) 0.058 (2) 0.92; inspection and cleaning (1) 0.096 (2) 0.076.

Discussion

In the discussion, Lt.-Col. E. Kitson Clark emphasised the importance of the cost of transmitting electricity and referred to the exposed position of the overhead lines to hostile attack. Professor Lomonossoff (who designed the first high-powered electric tractor) said that the criterion was the total cost per ton-mile gross, which could be predetermined by equations which he put forward.

Mr. C. H. Merz considered that where the railway companies themselves planned an electrification scheme a very large saving could be effected, compared with any estimates so far put forward, by working it in with their other developments. The claim for electrification rested largely on reduced maintenance costs of rolling stock, and an increase in its application to main lines with dense traffics might confidently be expected. Improvements in other locomotives tended towards complication.

Sir Josiah Stamp expressed the view that the coal situation was always likely to be influenced politically, and costs would be uncertain. He wanted more knowledge of the relation between physical durability and obsolescence. He said that American engineers were turning from the inevitability of main-line electric traction towards the possibilities of developing the steam locomotive. In this country the loading gauge introduced limitations, but we were appreciably reducing maintenance costs, and there were devices for obtaining rapid acceleration similar to that provided by electricity. Speeding-up might result in economies that would off-set increased fuel consumption.

Mr. J. M. Fay said that the cost of battery traction would be equal to that of contact electric traction at somewhere between one and two million ton-miles per mile per year. A one-ton battery would provide energy for more than 300,000 ton-miles per year. The battery that had been in use for six months on the Great Southern Railway of Ireland was operating excellently. Mr. C. J. H. Trutch, admitting the advantages of electricity for suburban traffic, said that the oil-electric locomotive could save 43 per cent. of the annual working costs of a steam locomotive, which was higher than that possible with contact electrification.

Wing-Commander E. R. Cave-Browne-Cave also advocated electrification for suburban traffic, but for other purposes he believed that oil-engines coupled to high-speed generators would give results as good as contact electrification with a great reduction in locomotive weight.

Developments in Russia

Mr. A. P. M. Fleming, giving "An Engineer's Review of Soviet Enterprise," said that Russia occupied one-sixth of the land area of the world and had a population of 147 million of 200 nationalities. It had all the natural resources, except rubber, required for civilised needs and the leaders of the U.S.S.R. were determined to make the country economically self-supporting; 50 per cent. of the national income was being withdrawn from consumption for financing new State enterprise. There were twelve million industrial workers now, compared with two million before the war, and 50 to 60 per cent. in most factories were women.

For mass production unskilled labour could quickly be trained, but where individual skill and effort were necessary, such as in the manufacture of steam turbines and the bulk of electrical machinery, the output per worker was only about 50 per cent. of that in Great Britain or America and the work was rough in finish.

Lenin's slogan was "Electrification and Soviets = Socialism"; in 1931 the output of electricity was 7,700 million kWh, which was expected to increase to 12,500 million kWh this year, when the generating capacity would be augmented by 1,500,000

kW. The second five-year plan envisaged the electrification of transport, industry, and agriculture.

Mr. Fleming gave some details of the Dniepr Combine in the Ukraine, the first section of whose 550,000-kW hydro-electric power station was started up recently. He said that at the moment progress in pure science seemed to be ahead of that of applied science. Whether the plan succeeded within a given period or not he regarded as immaterial; the point was that considerable progress was being made in the face of the greatest difficulties.

During the subsequent discussion Sir T. Hudson Beare said that the success of the major operations in Russia could not be disputed. He supported the author's plea that we in Great Britain should watch what was going on, discarding political prejudices, and profit from Russian experiences.

Noise from Machinery

Dr. F. W. Carter, F.R.S., in a paper on "Magnetic Noises in Dynamo-electric Machines," dealt with vibrations caused by the movement of the magnetic field with the rotor of the machine, particularly such as resulted in howling noises. The vibrations were due to one or other of the members having a toothed magnetic structure which caused periodic vibration in the field. By mathematical treatment the conditions favouring vibration were elucidated and the relation between the frequency of vibrations and the numerical data of the machine determined.

Certain harmonics in the periodic magnetic forces acting on the teeth were essential to the vibration, and methods for computing the forces were discussed, particularly in their application to synchronous machines. In an appendix a comparison made between two machines indicated that one had some eighty times the potency of the other in producing sound. In a second appendix it was shown that the sound produced was not effectively broadcast unless the pulse of distortion which produced it travelled around the machine with a speed greater than that of sound in air.

In the discussion Dr. F. T. Chapman said he had investigated this problem in connection with the induction motor, which the author had specifically excluded from his paper, and had found that the magnetic forces left a single unbalanced component which had set up vibration on the rotor as a whole.

During the discussion of the paper read by Dr. G. W. C. Kaye on the "Suppression of Noise" reported by us last week, Mr. A. R. Cooper (chief engineer, the London Underground Railways), in a written communication, stated that experiments carried out by his company showed that most of the noise from the trains was due to the wheels on the rails and that it entered the coaches through the windows and ventilator openings.

Improvements had been effected, but these tended to be lost with increase of speed; noise production appearing to follow a square law. The use of rubber pads to isolate the permanent way from the concrete road bed made no appreciable reduction, but small ballast, of a particular nature, spread on the tracks to approximately rail level, had resulted in a considerable reduction of noise.

Rural Electrification

In the discussion on the paper by Mr. R. Borlase Matthews on "Rural Electrification and the Grid," reviewed in our last issue, Mr. W. B. Woodhouse suggested that the author had not given full credit to the power companies (which supplied 25 per cent. of the electricity used in Great Britain) for their pioneer work in rural districts. Some 300 farms, averaging 150 acres each, were supplied by the Electrical Distribution of Yorkshire, Ltd.; the consumption was about 1,500 kWh per annum, and the revenue £11 per annum, or 1¾d. per kWh for all purposes on the farm and farmhouse. Outside the farmhouse the use of electricity was not great, especially under methods requiring only two or three people to farm 1,000 acres.

The revenue from a rural district was limited by the sparsity of population and the low purchasing power of the inhabitants. Two villages in Yorkshire, where every inhabitant used electricity, called for capital expenditures of £3,000 and £6,700, and the first year's working gave returns of only 7.6 and 10.6 per cent. respectively. The compulsory wayleave powers granted under the Act of 1919 had been of great benefit. Local rates formed a serious proportion of the working expenses. One per cent. on the capital expenditure, which had been suggested in some cases, would bear very hardly on such developments. An increased use of electricity would come when people had more money and when apparatus for its use was reduced in price.

Dr. G. C. Garrard said that it had been suggested that poles and transformers were "premises" within the meaning of the Home Office factory regulations, although they were used only by the skilled workmen. If this were so, the cost of transformers on poles would be increased. A definite decision on the point should be given as soon as possible by the Electricity Commissioners.

Mr. G. Wilkinson drew attention to the merits of cast iron as an alternative or collateral heat storage medium to water; cast iron had only one-twelfth of the bulk of water for the purpose.

The Collision of Ions

Professor A. M. Tyndall, in a paper before Section A on "Mobility of Positive Ions in Gases," referred to work carried out by himself and Dr. Powell, which showed that minute traces of impurity might have a striking effect on the mobility of positive ions in a gas. Changes in the nature of the ions might be brought about by (1) the formation of a cluster of impurity molecules around the ion; (2) the production of ions of the impurity by collisions of the second kind; and (3) the phenomenon of electron exchange.

When sources of positive alkali ions were employed, traces of impurity were less critical because of the low ionisation potential of these metals. A study of the mobility of these ions in various gases had led, in certain cases, to a simple law connecting the mobility of an ion with its mass. The apparatus then became analogous to a mass spectrograph, in that it might be used to analyse the ions emitted by a given source. When the source of ions was a glow discharge, the high gas pressures employed permitted the study of types of collision processes relatively infrequent at the low pressures more commonly employed

The Photo-electric Cell

In a discourse on Tuesday evening on the photo-electric cell, Mr. C. C. Paterson said that the thermionic valve with its power of magnifying currents had enabled the cell to be put to numerous everyday uses. Modern cells passed a current strictly proportional to the illumination falling on them, which enabled them to be used for quantitative purposes.

The "trigger action," by which street lamps were lighted and extinguished, was also being used for counting objects as they passed along a moving band. The photo-electric cell could be used for continuously recording smoke density in furnace flues. With the assistance of gasfilled relays and contactors powerful machines could be actuated by light impulses. A demonstration was given of the opening of a door through the interception of a beam of light by an approaching person.

Sound reproduction for talking films was only possible through the photo-electric cell, the variation in colour density on the edge of the film causing fluctuations in current through a photo-cell, which were amplified and converted into sound by a loudspeaker.

Finally, the photo-electric cell was the key to television. The difficulties now experienced were not due to the vacuum cell, which was rapid enough in response, or to the thermionic valve, which was sensitive enough to magnify the weakest impulses. The present limitations were in the mechanical screening and the conveyance of the signals over wire or radio channels.

Other Contributions

Professor W. Cramp, in a joint discussion between Sections G and A (Mathematical and Physical Sciences) proposed a system of supplying lighting from the power mains that would be safe in gassy pits. From each phase of a transformer fed from the power mains a series circuit would be connected between phase and earthed neutral. This circuit would comprise the primaries of special transformers whose 12- or 25-V secondaries would feed one lamp, which would be extinguished or removed by the withdrawal of the lamp, tail, secondary, and yoke as one unit. The lamp fitting would be provided with a glass that would withstand an explosion or shot-firing.

Dr. H. Cotton and Mr. F. A. Hough described investigations made with regard to the pulling into step of a synchronous-induction motor. Cinematograph films have been taken showing the angular position at any instant of a mechanical model whose equation of motion was the same as that of the synchronous-induction motor. By this means a slow-slip motion could be examined instead of the high speed of an actual motor, on which the slip motion required was superposed.

The economical control of the speed and power factor of three-phase induction motors was dealt with by Dr. T. F. Wall. The characteristics of the standard equation for the circle diagram (expressed in complex quantities with the slip as variable) were considered. The author also showed how the most favourable circle diagram for any purpose might be selected and the motor operated on a shunt characteristic with the same circle diagram and with any desired no-load speed. Conditions were established for securing drop in speed with increasing load when a flywheel set was used to screen a network from fluctuating load.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

High-voltage Insulators

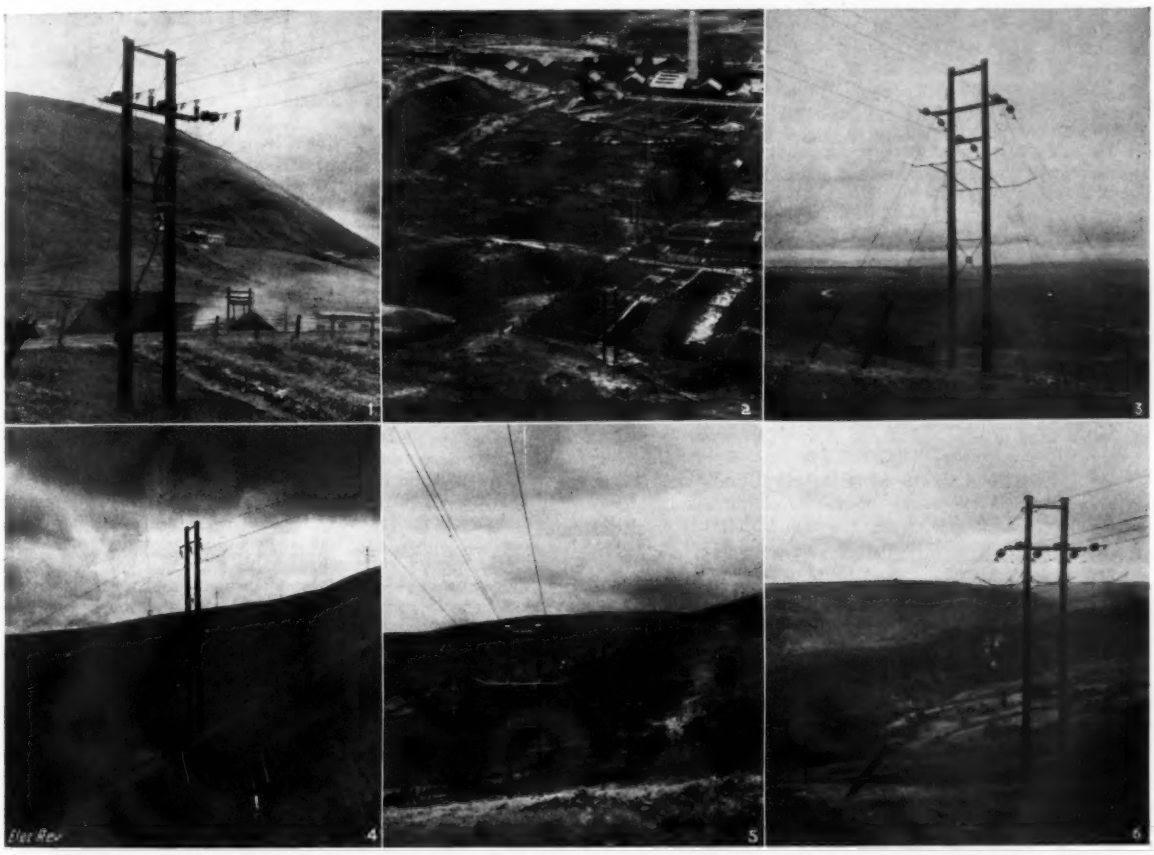
We have read with great interest Mr. Howard Miller's article on the subject of high-voltage insulators in the ELECTRICAL REVIEW of August 26th, and, generally, find ourselves in complete agreement with his opinions.

We consider, however, that an incorrect conclusion is liable to be drawn from Mr. Miller's reference to the practice of knurling jointing surfaces, as "the practice in England." The process known as sand-glazing was adopted by us well over six years ago, and many thousands of insulators of our manufacture, incorporating this improvement, are in use in England to-day.

We attribute the fact that neither we nor our customers have experienced trouble due to either thermal expansion or growth of cement to the use of this process, combined with the enlightened use of specially selected and treated neat Portland cement, with a semi-fluid coating on all jointing surfaces.

TAYLOR, TUNNICLIFF & CO., LTD.

Eastwood, Hanley, *August 29th.*



The Maerdy-Troedyrhiw Line: (1) A terminal pole at Maerdy; (2) A special pole with triangular disposition of conductors; (3) The approach to Ynysfais Colliery; (4) An H-pole in a steep run up; (5) A view of the line towards Ynysfais; (6) A span near the top of Maerdy Mountain **(see page 374)**

Suggested Electrical Engineers' Club

As one of the founder-members of the late Engineers' Club (London) I was pleased to read and agree with your recent counsel not to dismiss too hastily the possibility of establishing a new club for electrical men, or engineers generally. Although all the reasons for the failure of the old Engineers' Club are not commonly known, what you refer to as the financial burden was undoubtedly one of them, and it may be well to consider how such a burden might be avoided, or at least minimised in the future. Some suggestions are here submitted.

First, all grandiose schemes, particularly in respect of premises, should be shunned. Rooms might be limited to those for reception, dining, "coffee," reading and cards, with the usual offices. Sleeping accommodation might be omitted, as it should be possible to obtain special terms for members from a centrally situated and preferably near hotel. The food and drink department of the club should be capable of making a net profit, if conducted competently. Such a general scheme might permit the major part, if not all of the subscriptions to be used for providing the amenities expected in a club, *i.e.*, those not to be found in a restaurant or hotel.

The subscription should be reasonable, having regard to all the circumstances. The original membership of the Engineers' Club was about 3,000. As a basis of some sort, admittedly optimistic, a few arbitrary figures are cited. Suppose there are 500 town members at £5 per annum and 1,000 country members at £2 10s. per annum, an income of £5,000 would be available. This seems a lot of money to provide club amenities alone, and it would be interesting to know what facilities an established restaurateur would offer for an annuity of, say, £4,000 plus the benefit accruing from a thousand or so extra meals with drinks, per week. Those readers who are interested and have friends in the catering business might with benefit contribute suggestions.

With regard to preliminary expenses, I should imagine that an approved scheme would have the sympathy and support, as patrons, of many senior individuals, firms and associations connected with the engineering industries. Other things being equal, club quarters in the Westminster district seem more likely to secure the support of potential members than in the "West End," but this is a matter of expediency.

It has been stated that the old club lost a number of members owing, among other things, to touting, and the election willy-nilly of seniors and juniors of the same firm. Rules as to conduct and eligibility should be able to regulate these alleged difficulties. Finally, I suggest that the views and co-operation of "young blood" should be sought and encouraged to the fullest extent.

Barnes, S.W.13, *September 5th.* FREDK. J. COLLIS.

I thank you for the kind and encouraging notices you have given to the above suggestion. From the letters which I have received privately—in addition to those which have appeared in the electrical Press—all show in favour of it while a small minority favours the principle, but doubts the practicability.

I have had no experience whatsoever in running such a club, and I realise that it may be decided, after investigations have been made, that the scheme is unworkable. At the

same time, one is aware of some of the causes which closed the original Engineers' Club (not the least of which I should imagine was the rent); these causes are surely not particular only to engineers' clubs, and others have survived them. Cannot we engineers make at least another attempt, or is that first failure to damn all other efforts?

My own impression is that the majority of engineers are not habitual club men, but at the same time do, on more or less frequent occasions, feel the need for such facilities that a club provides. Due to this bad " usage factor " the numbers must be exceptionally large, and whatever constitution may be adopted it should be designed to embrace the whole of our Institution membership.

Support sufficient to warrant development of the suggestion has now been indicated, and I hope to be able to make a further announcement next week.

Ruislip, *September 5th.* REGINALD N. PEGG.

As an original member of the Engineers' Club I doubt very much whether any club in London devoted solely to one profession can ever be a success, particularly if the profession is a commercial one such as engineering. There are no clubs for doctors or lawyers only, but if there were they would not be overwhelmed by the manufacturing side, which is what happens (or did happen) in the Engineers' Club.

The trouble with this club was that it was not a club at all; it was a meeting place! Can you imagine any club in London where manufacturers could take a complete table at the club's annual dinner and invite guests? Yet this happened, I believe.

My idea is that many of us without a club would like to join one, but to enjoy it we should have some friends among the members, and it should be possible in these lean days for clubs to find one which would welcome a large increase of membership. This would provide a recognised club where one could meet one's friends and yet not be overwhelmed by salesmen. No doubt, given an adequate number of members, any club would give them representation on its committee so that their particular views might be considered.

ALAN N. EAST, M.I.E.E.

Abbots Langley, Herts, *September 5th.*

The Effects of Electric Shock

Some years of experience of shocks of various intensities made me contemptuous of 230-V a.c. until I learnt my lesson a month or so ago. It was a hot day and my hands were moist. I made contact with the live pin of a three-pin plug with my right hand, whilst holding earthed metal in my left. I merely flicked against the pin but immediate contraction of my hands made still better contact, and I realised quite clearly that I was trapped.

I tried hard to shout and could make no sound, but I remember that, by what seemed a great effort, I turned so as to gaze fixedly at the main switch so that anyone would understand and switch it off. I experienced absolute agony, as if every bone was being separately pulverised, and it seemed possible to count the periods of the 50-cycle supply.

Eventually blackness descended and I fell over, but as I fell the current was cut off and the immediate feeling was one of intense relief, followed by extreme exhaustion and a thumping heart, beating very slowly. I was not greatly inconvenienced, however, and next day was in practically normal condition. Peculiarly enough, other plugs do not scare me, but I had a certain distinct nervousness when handling the one from which I got the shock; that feeling has now worn off. I had about a dozen burns, mostly of minor character, on my hands; one or two were troublesome but are now healed.

I hope that this may catch the eye of electrical colleagues who, due to familiarity and experience of shocks, think as I did that 230-V a.c. is not sufficient to hurt. Given proper contact it will certainly kill if sustained for sufficient time.

September 1st. C. M. D.

The Need for Educating the Public

I enclose a cutting from to-day's *Daily Mail* from which you will see that once more the tragedy of fatal shock has occurred in a private house. At the moment I have no accurate details of the accident, but can only suppose that this man was using a flex and bare brass lampholder in the presence of earthed metal, namely, the water cistern.

It does seem a pity that valuable lives should be lost in this way, when manufacturers have invented and put on the market every conceivable design of shock-proof lampholder and Home Office hand lamp. There is no authority which has any jurisdiction over the installation of a private house, but extremely valuable work could be done by any society which was keen enough to give lectures in general electrical education, touching upon just such matters as these.

Should this letter come before the eye of any of our societies for the furtherance of electrical interests, I trust they will not think that I am trying to decry their work, for which I have the highest admiration.

Orford, Warrington, *September 5th.* N. S. BYERS, Engineer, Orford Tannery.

[The cutting records the death of a Warrington man who was repairing a water cistern in an attic. Apparently he was using a lamp attached to a length of flex when he slipped and plunged the hand holding the lamp into the water.—EDS. ELEC. REV.]

Ironbridge Power Station

It has been brought to our attention that you refer to the screens at Ironbridge power station as being the first of their kind to be put into operation. No doubt you had in mind our latest development of " band " screen, namely, our patent " central flow " type, but we have had several screens of this type in use for some considerable time now.

For instance, those at Norwich and Preston power stations have been in use since the end of 1929 and the beginning of 1930. The same applies to Southampton where the installation is of a little later date. We have several others abroad which have also been in service for some time.

F. W. BRACKETT & CO., LTD.
F. W. Brackett, *Managing Director.*

Colchester, *September 5th.*

[In the same article we referred to the use of an " Ingenia " remote level indicator. We are informed by Messrs. James Gordon & Co., Ltd., that the name is " Ingema," and are glad to take this opportunity of making the correction.—EDS. ELEC. REV.]

The Bakers' Exhibition. By Viola Ripley, B.Sc.

THE Confectioners' and Bakers' Exhibition opened at the Agricultural Hall on September 3rd and closes to-day, Friday. From the exhibits it would seem that safety devices are being used increasingly on kneading and mixing machines as well as on the high-speed slicers.

C. O. Ericsson Engineering Works, Ltd., shows a " Master " mixer with a 2-h.p. enclosed, fan-ventilated motor, with push-button control. It has a patent variable friction gear, allowing twelve different speeds to be obtained while the machine is in motion. The " Junior Master " employs a ½-h.p. motor. Read's Mixers and Oven Co. exhibits a mixer with three speeds, having a silent chain drive. The e.v. motor is mounted on the machine. The " Ellerstyle " dough mixer is fitted with a safety disc guard with electric interlock. The Artofex Engineering Works, Ltd., has a new mixing machine with interlocking arms. Messrs. Baker, Perkins, Ltd., put forward a new design of cake mixer mounted with a 5-h.p. motor on a common base-plate. The drive is taken through oil-bath lubricated, machine-cut gears and two speeds are provided, changeable whilst the machine is in motion. Messrs. John Hune display an 80-quart cake mixer of their standard pattern.

C. O. Ericsson Engineering Works, Ltd., also shows a dough depositor and the " O-matic " moulder and filler, both provided with ½-h.p. fan-ventilated motors. Messrs. Baker, Perkins exhibit an electrically driven divider and moulder, and Messrs. Waddell's show a dough and biscuit brake with direct motor silent chain drive. Mason's " Vik " moulding machine is electrically driven. The automatic bread checking machine shown by Southall and Smith throws out the light-weight loaves. The Hobart Manufacturing Co. demonstrates an electrically driven potato peeler motor of 12-lb. capacity.

Messrs. Baker, Perkins claim for their new peel ovens the advantages of very regular distribution of heat, easy manipulation, absolute control of the baking heat and cleanliness. The " Jones " ovens shown by the Bristol Steam Oven Works are of three types, " E 1 " constructed for quick initial heating, " E 2 " for quick change of heat, and " E 3 " a storage type. Charts for the " E 2 " type show that the initial heating period is only one hour and after that a minimum of heat is required to maintain the temperature. Messrs. Melvin and Gillespie's oil-fired ovens have electric fans and automatic electric control gear arranged to cut off the oil supply if the fan fails. Messrs. Collin's ovens are fitted with a patent electric lighting system.

The Ellerstyle Engineering Co. show electrically heated dies for pastry moulds. The Waddell pie machine is electrically heated, the advantages claimed being steady temperature and absence of fumes and smoke. Messrs. T. Errington and Sons exhibit electrically heated melting and dipping pans, which can be run off the lighting circuit, and a pie warmer. Messrs. Morton's whisking machine can be supplied with electrically heated air. The Sodazone Co. displays a new table model soda fountain with freezing and storage cabinets in the same table and a food cupboard underneath.

On the stand of the General Electric Co., Ltd., there is a double-deck peel oven which is in frequent operation for baking the bread which is sold at the exhibition refreshment rooms.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Cigarette Lighter

The latest product to be marketed by THE DOWSING RADIANT HEAT CO., LTD., Bollo Lane, Acton, W.3, is a cigarette lighter

The "Dowsing" cigarette lighter

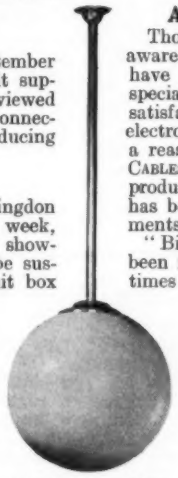
which works from the mains supply. It is fitted with a push switch, flex and adapter, and is loaded at 100 W. The price is 10s. 6d. This neat little appliance is one of those which put a finishing touch to the electric home.

M.K. Switchplugs

M.K. ELECTRIC, LTD., announce that as from September 1st all the single-pole three-pin switch-plugs which it supplies will be interconnected in a clockwise manner viewed from the front. Switch-plugs for other methods of connection must be specially ordered. The company is introducing a new 5-A fuse-plug.

A New Lighting Fitting

MESSRS. FALK, STADELMANN & CO., LTD., 89-93, Farringdon Road, E.C.1, have brought out the "Globelite" this week, and we took an opportunity of inspecting it at their showrooms. There are four models, and the globe may be suspended from a ceiling plate designed to fit a conduit box with two-inch centred screw holes by a chain or tube, or fixed to a wall bracket with a 2¾-in. back plate, or used with a fixed ceiling plate. Two-ply glass giving even diffusion is used for the globe, which rests on a flange, the gallery being screwless; the adequate vent holes are protected. Prices of the chain or tube model are: 8-in. diameter, 13s. 9d.; 10-in., 15s. 3d.; 12-in., 18s. 3d. The other types are somewhat cheaper. A feature of this fitting is that it may be knocked sideways without breaking or coming off, yet at the same time it is easily lifted off when the pressure is exerted in the right way.



A tube suspended "Globelite"

All-electric Drilling Machines

A new range of all-electric ball-bearing drilling machines with from one to four spindles, has been introduced by MESSRS. ALFRED HERBERT, LTD., Coventry. Quick operation is obtained by finger-tip control (an important feature) of starting, stopping, and reversing; the easy method of speed changing is claimed to increase the output per sq. ft. of floor space by 25 per cent. Dust-proof ball bearings are employed throughout, obviating renewal of lubricant and adjustment.

The design of the multiple-spline spindles (which are plain or geared with hand or self-engaging automatic feeds), enables the feed to be engaged when reaming as well as when drilling. Each spindle is driven by a variable-speed motor of the pole-changing type. For 50-cycle supplies four speeds are available with plain spindles (from 445 to 1,455 r.p.m., or, alternatively, from 450 to 2,850 r.p.m.), and eight speeds with geared spindles (from 106 to 1,455 r.p.m.). These changes are made by a speed-selector switch, with its rotating part mounted on ball bearings. Starting, &c., is performed by a drum switch with a lever at the front of the machine.

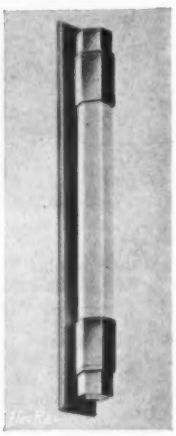
For a.c. supplies (type "V" machines) the plain spindles are suitable for drilling up to ¾ in. in steel, and 29/32 in. in cast-iron, and the geared spindles up to 1 in. and 1¼ in., respectively; the latter will also tap up to ⅝ in. in steel and ¾ in. in cast-iron.

Type "C" machines can be used on either a.c. or d.c. circuits. Each spindle is driven by a constant-speed motor; four speeds are available, 448 to 2,415 r.p.m., for plain spindles, and 104 to 562 r.p.m. for geared spindles. The duty of the plain spindles is the same as that of the type "V" machines, but the geared spindles will drill up to 1¼ in. in steel and 1¼ in. in cast-iron and will tap up to 1 in. in steel and 1¼ in. in cast-iron. A variation of this machine with one spindle and a geared speed of 3,000 r.p.m. is especially suitable for woodworking trades. Other machines in the range are the type "C" tapping machine (which has one spindle speed only), type "C B" (similar to the preceding, but belt-driven with fast and loose pulleys), and type "O" (suitable for driving by belt or self-contained motor), and type "O" bench machine.

Apart from the finger-tip control referred to, other sound features of the range are ease of installation, quicker and easier operation to reduce idle time, adaptability of driving arrangements to suit existing conditions (whether electrical or belt-driving), and the ability to run small drills at correct speeds without trouble from breakages.

Modern Lighting Fittings

MESSRS. WILLIAM MCGEOCH & CO., LTD., Warwick Works, 46, Coventry Road, Birmingham, are developing a tubular bracket fitting with hexagonal and square tubes, a type which has not been taken up much in this country. We illustrate the type "No. 5034," with a hexagonal opal or frosted glass tube to take a double-ended tubular lamp. The price with tube is 26s. Type "No. 5035" is similar but is fitted with a square tube and sells at 25s.



A "McGeoch" fitting

A New Electrode Metal

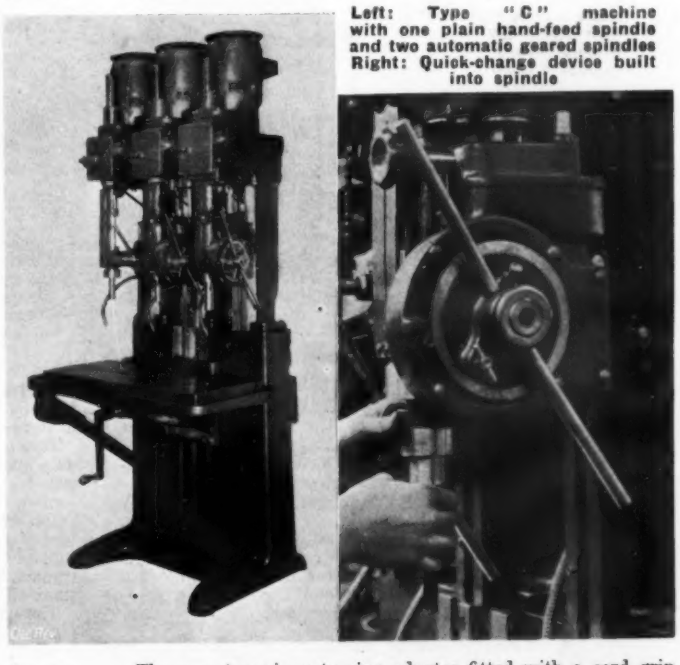
Those familiar with spot welding are aware that pure copper electrode tips have a comparatively short life while special metal inserts are not always satisfactory. To meet the demand for electrode tips having increased life at a reasonable cost, BRITISH INSULATED CABLES, LTD., Prescot, Lancs., have produced a new type of metal which has been found to fulfil these requirements.

"Bicaloy," as the new metal has been named, is claimed to have a life of from four to eight times that of high conductivity copper on the bulk of ordinary work. Tips made of this material are also cheaper than those made of copper with metal inserts; moreover, the latter can be used only where the water supply can be brought near the nose of the tip, and this is sometimes impossible with tips of special shape.

"Goltone" Wiring Accessories

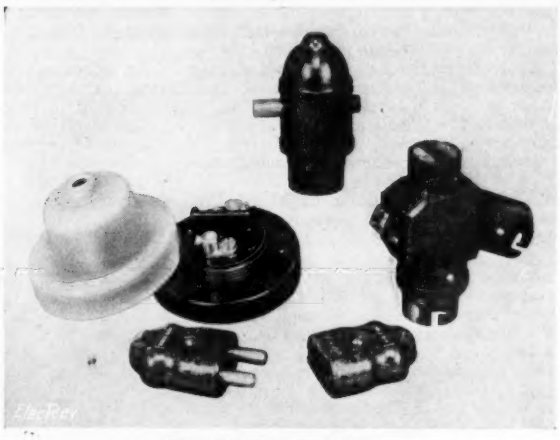
MESSRS. WARD & GOLDSTONE, LTD., Pendleton, Manchester, have sent us samples of some new fittings which they are now marketing. The switch-lampholder embodying a two-way adaptor is of neat design and the quick-make and break switch-toggle indicates "on" and "off" according to position. The price is 3s. 3d. There is also a new shade-ring pattern cord-grip switch-holder fitted with a push-bar switch. The bar is coloured black on one side and red on the other, the black side projecting when the switch is in the off position. The price is £1 4s. a dozen.

Left: Type "C" machine with one plain hand-feed spindle and two automatic geared spindles Right: Quick-change device built into spindle



The new two-pin extension adaptor fitted with a cord grip and a 5-A British Standard plug and socket sells at 1s. 6d.—

the socket costing 8d. and the plug 10d. The new ceiling rose, type A9/121, has a brown " Bakelite " base and a brown or



New " Goltone " fittings

white " Bakelite " screw-on cover which fits completely over the base. The rose, with cover, is 2 11/16 in. in diameter and sells at 8s. per dozen.

The switch lampholders have been tested by the Birmingham University, when each switch satisfactorily passed an endurance test of 6,000 operations at the rate of ten per minute at 250 V, 50 cycles, carrying 1.0 A. The temperature rises for six different switches were 12, 7, 7, 8, 9, and 6 deg. C. All the switches passed an overload test of 1½ A d.c. at 250 V, being operated fifty times. The company's pear-type switches passed similar tests at the same time.

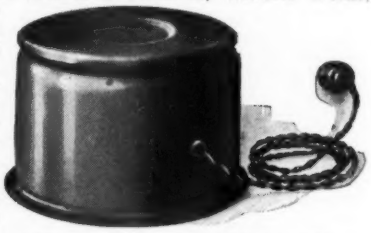
A Cabinet Incubator

A recent addition to the range of incubators made by the CURFEW ELECTRIC HEATERS, Curfew Poultry Farm, Gogmore, Chertsey, is the cabinet incubator. This model has very thick walls packed with heat insulating materials. The egg trays are carried in a spindle frame, the handle of which extends through the front of the incubator so that eggs can be turned without opening the incubator. An arrangement provides for the hatching of 25 per cent. of the eggs every five or six days.

Large water trays are arranged under the hatching trays, and are kept automatically filled by a specially designed syphoning tank. A combined thermometer and hygrometer is incorporated. The heater and fan are fixed to a removable panel and all controls are outside the incubator. Several models are made, from one of 1,000-egg capacity, costing £55, to models for 12,000 eggs. A typical example is illustrated on page 373.

A Window Display Turntable

The " Selmore " electric rotary table is a line recently developed by MESSRS. ADKINS & PHILPOTT, Windsor Works, Banbury, Oxfordshire. Model " A.C.5," priced at 35s., consists of a small turntable—6 in. diameter by 4 in. overall depth—rotating at approximately 3 r.p.m., which can carry weights of from 5 to 10 lb. It is suitable for a pressure of 200-250 V a.c.



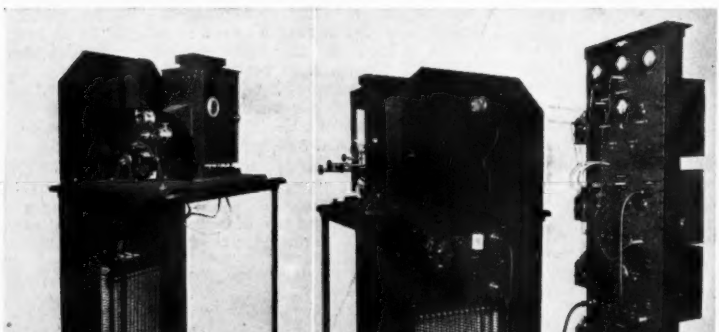
The " Selmore " " A.C.5 " turntable

Type " D.C.5 " is similar, but is designed for use on d.c. voltages from 100 to 250. The price is £2 5s. Model " A.C.50," designed for a.c. at 50 cycles, carries 50 lb. at 3 r.p.m. The depth is 4½ in. and the diameter 10 in. It costs £3.

A Marconi Television Demonstration

A SYSTEM of television by wireless developed by the research engineers of the Marconi Company was demonstrated for the first time during the meeting of the British Association at York. Television images were transmitted by wireless from the Marconi Works, Chelmsford, to St. Peter's School, York, a distance of 180 miles. A description of the transmitter appeared in our issue of July 22nd (page 129).

The demonstration took the form of sending verbal messages from characters printed on a moving tape, which was passed



The Marconi television apparatus described in this article

through the transmitter at Chelmsford at speeds corresponding to sixty words per minute and upwards, the words being read like a moving sign on a ground glass screen in the receiver at York. Arrangements were made this week to " televise " images of moving figures over a local circuit, and the demonstration proved of considerable interest to the visitors.

Three different types of television receivers were installed by the Marconi engineers: the television " news " receiver with a ground glass screen 25 in. by 3 in. for the reception of printed messages; the television " Broadcast " receiver giving a moving picture on a screen 8 in. by 8 in.; and the television " projector " receiver, which is capable of throwing a moving picture on to a white screen four feet square.

The Receiving Equipment

The television signals were received at York by means of a simple three-valve radio receiver designed to have a very broad frequency response curve with an anode bend detector and one stage of low frequency amplification. The output from this receiver was taken to a power amplifier for use on the 15-line tape scan " News " receiver. In the latter a sodium tube of the dumb-bell type is mounted close to an aperture, the modulated light being projected on to the screen by means of a mirror wheel, driven by a synchronous motor and giving a horizontal scan. The speed of the mirror wheel is 1,200 r.p.m., and it gives twenty pictures per second. The 50-line " Broadcast " receiver has similar characteristics. This and the 50-line " Projection " receiver give fifteen pictures per second. The television " Broadcast " 50-line transmitter operated at York sends pictures at the rate of fifteen per second from any high-class broadcast transmitter. In addition to the scanning apparatus, photo-electric cell and amplifier system, circuits are provided :—(a) For maintaining the motor driving the scanning disc at a constant speed; (b) for generating synchronising impulses which are passed to the receiver and there synchronise the receiver motor with the transmitter motor; (c) for " monitoring " the transmitted picture, *i.e.*, checking the type of picture being transmitted; and (d) for control purposes.

The scanning machine comprises two Nipkow discs, motors for driving the discs, two projection lenses and an arc lamp. The transmitting disc proper is constructed of thin aluminium sheet which is punched with fifty square holes .45 mm. in size. These holes are arranged round the disc in the form of a spiral and are spaced at 7.2° apart, each hole differing from the preceding one in radius to the centre of the disc by exactly its own width. The disc is driven directly by a 100-V ¼-h.p. synchronous motor which is driven from a d.c. supply and maintained at a constant speed by a separate a.c. supply. At right angles to the transmitting disc is a second disc which is used for the purpose of " monitoring " the transmitted picture. This is driven by a second motor which is kept in strict synchronism with the motor driving the transmitting disc.

The line amplifier is a simple resistance capacity coupled unit employing five valves, four of which are in cascade, the last two being paralleled off, one to the line output transformer and the other to the monitoring amplifier. The fork amplifier and fork unit consist of an electrically maintained tuning fork and a resistance capacity coupled amplifier. The constant frequency output from this amplifier is fed into the transmitting disc motor and serves to maintain this at a constant speed.

The photo-cell system consists of a photo-cell " Type CMG8 " (spherical), mounted in a parabolic reflector at the focus, and a small amplifier. The synchronising unit is designed to receive impulses generated by the motor driving the transmitting disc, and to amplify them by means of a special circuit in such a manner that a constant amplitude synchronising impulse is inserted at the end of each scan line impulse.

The Blackpool Lighting Conference

The ninth annual meeting of the Association of Public Lighting Engineers

THE conference of the A.P.L.E. opened at Blackpool last Monday evening. After the Council meeting an exhibition of lamps and lighting appliances was opened at the Imperial Hotel by the Mayor of Blackpool. On Tuesday morning Mr. Harold Davies delivered his presidential address. There was a record attendance of 280 delegates.

This address related mainly to street lighting in Chesterfield in which there are 1,673 gas lamps and only thirty-two electric

The "Sheffield" street-lighting reflector

lamps. This is very sad, considering that Chesterfield claims (ELEC. REV., August 19th, 1932, p. 263) the distinction of being the first English town to adopt electricity for the whole of its public lighting. Such is the penalty that sometimes attaches to the pioneer! Mr. Davies referred to a questionnaire sent out on behalf of the Association which showed that out of 132 towns included only eleven employed whole-time lighting engineers to control and supervise public lighting. He expressed the view that better results at no additional cost would be achieved if such an appointment were made in all towns.

In Chesterfield the percentage times apportioned to different sections of work last year were as follows: Cleaning, 49.2; clock winding and setting, 23.9; service, 13.3; inspection, 10.9; miscellaneous, 2.7. Lighting failures were 1 per cent. with gas suspension lanterns and 0.5 per cent. with square lanterns. With the former 50 per cent. of the failures were due to by-passes and 20 per cent. to naphthalene; with the latter the proportions were 25 and 50 per cent respectively.

The Need for Public Lighting Engineers

Subsequently, Councillor R. H. Minshall, in a paper on "The Adminstration of Public Lighting," urged the need for the appointment of a fully qualified lighting engineer in every town. He should be regarded as a chief official, with an adequate salary, in sole control of an independent department. He must be provided with an adequately equipped photometric laboratory. Since the appointment of a public lighting engineer in Sheffield the cost per candle had been reduced from 2s. to 6¼d. In 1922-23 Sheffield spent £54,000 on 11,324 electric and gas lamps, with a total c.p. of 500,000; in 1930-31 the expenditure was £63,000 for 20,192 lamps of 2,353,000 c.p. Increase in cost of public lighting was inevitable due to the increase in volume and speed of traffic. In five Midland towns the cost varied from 7s. to 2s. 6d. per head of population.

During the subsequent discussion disappointment was expressed by the lay members that the relative merits of electricity and gas had not been discussed. The suggestion was made that Government assistance should be forthcoming for street lighting improvements by the taxation of motorists, but generally Government interference was deprecated.

Recent progress had been largely due to the appointment of public lighting engineers and to the work of the Association, but it was held by several speakers that the smaller towns could not afford to retain whole-time officers for supervising street illumination; nevertheless, the great need in all cases was expert advice of an impartial character.

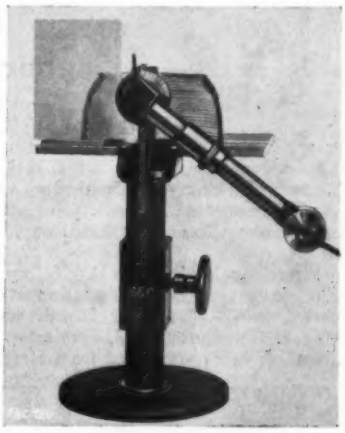
British Standard Installations

On Wednesday morning papers were read on the planning of installations to conform with British Standard Specification No. 307-1931. Mr. G. H. Wilson handled the electrical case, which was based upon data supplied by the General Electric Co., Ltd., the Edison Swan Electric Co., Ltd., the Electric Street Lighting Apparatus Co., Ltd., and Holophane, Ltd. Mr. Wilson's paper deals with the subject thoroughly and at length. It is divided into: (1) a discussion of the specification itself; (2) planning an installation; and (3) three appendices in which performance curves for modern equipment are given. The paper is illustrated by thirty-eight diagrams. The constants of an installation are discussed, and information is given to assist in the choice of a British Standard Class, the unit of system, and the type of light distribution for the unit.

A flexible method of calculation, by which the lantern can be chosen to fulfil the requirements of a given installation, is described with diagrams. A method of calculating average illumination and systems of plotting iso-foot-candle diagrams is also included. It is hoped that the methods described will enable the public lighting engineer to rough out quickly a design for a particular installation.

The Lighting of Small Towns

Among the papers devoted to the public lighting of towns of small and medium size was one by Mr. H. Collins, of Colchester. In his area there are 657 electric and 717 gas lamps, with a total c.p. of 151,700 or 3.12 per head of population. The former vary from 60 to 500 W, and the latter are all twin bijou inverted mantles with a consumption of two cb. ft. per mantle per head. Lighting is from sunset to 11 p.m., except for forty-five electric and twelve gas all-night lamps.



The "Ray-Path" apparatus

Electric lamp maintenance last year averaged £3 0s. 8d., made up of: materials and paint, 3s. 4d.; lighters and cleaners, 16s. 4d.; fitters, 2s. 3d.; painting (wages), 11d.; electricity (100-W lamps) at 2¾d. per kWh, £1 15s. 6d. Gas maintenance averaged £2 10s., made up of: materials and paint, 3s. 4d.; lighters and cleaners, 19s. 6d.; fitters, 2s.; painting (wages), 11d.; gas at 3s. 11d. per 1,000 cb. ft. (470 B.th.u. and 2 in. minimum pressure), £1 4s. 3d.

The lighting of the new by-pass road will be by 300-W electric lamps in "Bi-Multi" reflectors with the light source 23 ft. above ground level. For the greater part of the four miles an overhead cable will be carried on steel-lattice poles 120 ft. apart; a lamp will be placed on every alternate pole. Electricity will be supplied at £32 2s. 6d. per annum per kW and 1d. per kWh.

The Exhibition

The stands numbered twenty-six, of which fifteen had an electrical interest. The Horstmann Gear Co., Ltd., showed a "Newbridge" time switch with solar dial for unit street lamps, and Benjamin Electric, Ltd., the "Duofflux" floodlight and other fittings. The Electric Street Lighting Appara-

A "Viewoscope" for studying street-lighting problems

tus Co. exhibited samples of the "Esla," "Ei-Multi," and "Multi-plane" fittings. Holophane, Ltd., showed a series of prismatic reflectors with various light distributors and with bowl, dome, and band reflectors and a large ornamental type of fitting.

The equipment exhibited by the Credenda Conduits Co., Ltd., included a selection of industrial and street lighting fittings, including the Glasgow, Johannesburg and Huddersfield types, the dome reflector lantern, and the new high-mounting and asymmetrical reflectors. Venner Time Switches, Ltd., displayed various types of clocks and relays, including dual-frequency, self-starting synchronous 200-r.p.m. motors, and a full range of switchgear.

The Wardle Engineering Co., Ltd., exhibit consisted of pillar mounting brackets, with switch-fuse boxes and spigot caps, and different types of street lanterns, including several new designs. The General Electric Co., Ltd., was showing the new "Ray-Path" apparatus, which enables cases of total internal reflection within the glass of a reflector or refractor to be detected; the "Viewoscope" for studying street lighting installations from a model by varying the spacing and intensity of the lighting system, and the character of the mimic road surface; a new portable electric photometer, which is designed to obtain precise readings by means of an "Osram" photo-electric cell, the human factor being eliminated; and a number of new refractors.

Electric time switches, from 5 to 60 A, s.p. and d.p., for single, two, and three-phase systems were displayed by the British, Foreign and Colonial Automatic Light Controlling Co., Ltd. Amongst the exhibits of Revo Electric Co., Ltd., were the new "Westminster" fitting and other similar units, standards, brackets, and a traffic signal in operation. The principal item on the stand of Siemens Electric Lamps & Supplies, Ltd., was the "Sheffield" street lighting reflector, which was shown in 200, 300, and 500-W sizes. Ranges of lamps, floodlighting projectors, and time switches were also on view. Radiovisor Parent, Ltd., exhibited both a.c. and d.c. light-sensitive control units, embodying several improvements.

The Edison Swan Electric Co., Ltd., displayed the "Piccadilly" 1,500-W lantern, the new "London" lantern, the "Super-Extensive" 500-W unit for lighting large areas with a combination of two reflectors to secure concentration of light at 65 deg., the general purpose 1,000-W floodlight, the "Tori-" 250-W floodlight, and a transportable traffic obstruction signal.

The exhibit of the Engineering and Lighting Equipment Co., Ltd., comprised lanterns, ornamental brackets, contact gears, raising and lowering equipment, time-switches, heavy-duty lampholders, and an anti-vibrator attachment. The Kandem Electrical Co., Ltd., had a range of lanterns for lamps of from 100 to 1,500 W, the "Dia" long-burning flame arc lamp, floodlights, and moisture-proof fittings.

A Suburban Railway Electrification Scheme

The extension of the L.M.S. Bow-Barking line

YESTERDAY we were present at the trials of the newly widened and electrified L.M.S. line of 7¾ route miles between Barking and Upminster, which will be opened to the public on Monday next. The intermediate stations served are Upney, Becontree, Heathway, Dagenham, and Hornchurch.

Electricity is taken at 11 kV from the County of London Electric Supply Co.'s sub-station at Heathway, and is converted to 630 V at four L.M.S. sub-stations at Heathway, Upney, Hornchurch, and Upminster. The last three are unattended, being controlled from Heathway. Each sub-station contains two 1,200-kW sets; those at Upney and Hornchurch are metal-tank rectifiers made by the B.T.-H. Co. and the G.E.C. respectively, and at the others rotary converters by the same two manufacturers.

Above: Upminster station showing the track. Below: The Heathway sub-station

The main transformers at Heathway are indoors: elsewhere they are outside the building adjacent to a siding. Reyrolle high-voltage and Bertram Thomas low-voltage switchgear is installed. For the automatic signalling supply a single-phase 11-kV/400-V transformer is connected to Reyrolle high-voltage switch fuses in each sub-station.

The high-voltage cables (15 miles) and pilots (9 miles) between the sub-stations, carried on each side of the track on posts, were supplied by British Insulated Cables, Ltd. For the control of the automatic sub-stations the Bertram Thomas system has been adopted. A 16-core pilot cable is run from Heathway (in which two 250-V 108-A batteries are installed) to each of the other three.

In the two rectifier sub-stations Westinghouse rectifiers automatically come into service if the pilot supply should fail. At Upminster correct polarity of the rotaries at starting is ensured by a 250-V polarising battery, which also comes into service on failure of the pilot supply. Control is effected by push-buttons: "start," "stop," "close breaker," and "open breaker" for the rotaries and rectifiers, and "close" and "open" for each h.v. feeder and track feeder. Continuous indication is given of the total load and bus-bar voltage at each sub-station.

As the track is an extension of the existing Bow-Barking lines, the four-rail system is employed, with both conductor rails insulated. Line-side contactors have been installed at section gaps, about 250 yards (a 12-coach train length) ahead of main gaps at each sub-station. These contactors operate simultaneously with the track section breakers through set and trip coils, and are held closed mechanically. Their function is to prevent a train bridging a sub-station gap and causing current to be transferred to a dead section.

Colour-light Signalling

Automatic and semi-automatic colour-light signals (37 in number) of the searchlight type with high-beam candle-powers have been adopted. When the signal is at "danger" train stops project an arm to engage with a trip cock on the train. The colour-light signalling work, including signals, train stops, &c., was carried out by the British Power Railways Signal Co., Ltd. The cable work and all telephone and signalling work was done by the railway company; this included the semaphore signalling and track circuiting, and the provision of a set of power operated facing and trailing points at Barking East, and the semaphore signals, &c., at other places.

It is estimated that approximately 6,000,000 kWh per annum will be purchased for the 2¼ million car-miles per annum which will make up the service.

Small Orders and Profits.

By A. W. Willsmore, F.R.Econ.S.

IT is suggested that the electrical manufacturing industry has given insufficient attention to the effects of the tendency towards "hand-to-mouth" buying on the part of its customers and the consequent reduction in the size of the average order. The manufacturer may argue that in actual fact it makes no difference to him whether he takes £100 worth of business in the shape of one individual order or twenty small orders. In actual fact, however, the twenty small orders would result in less net profit than the one large order even though the goods sold were the same and the sales were all effected at the same selling prices. This arises from the disproportionately high cost of handling and clerical work involved by small orders compared with large.

Apart from this feature, the existence of conditions where business is taken in frequent small orders rather than occasional large ones implies other disadvantages so far as the manufacturer is concerned. Superficially, frequent small orders might be expected to result in a more stabilised manufacturing programme. In actual fact, immediate delivery from stock is usually required on the small orders, and no greater degree of stability in production can be secured than that possible through the adoption of a stock ordering policy available in any event. Small and regular orders do not help the factory under these conditions, they merely imply that the manufacturer is burdened with the necessity for carrying stocks that should be carried by his customer.

The Distribution of Charges

The fact that small orders for delivery from stock shift the investment burden from the customer to the manufacturer will probably be admitted without challenge. There may, however, be sceptics who doubt the suggestion that small orders imply higher unit costs than large orders. A recent investigation made in the United States by the Brooking Institution showed that the clerical and handling costs involved by small orders were disproportionate to those involved by large orders. For instance, whereas the handling and clerical costs on an order worth £20 amounted to £1 8s., the corresponding costs involved by five separate orders each worth £4 amounted to a total of £5 6s.

The following table, based on the report of the survey of 115 representative companies, shows a comparison between the total costs of five separate orders and of one order of an equivalent value to the total of the five small orders:—

	One order	Five small orders
Recording costs	100%	440%
Billing costs	100%	410%
Credit work	100%	485%
Collection costs	100%	505%
Packing costs	100%	270%
Transport and handling ...	100%	260%
Shipping	100%	280%

These figures are, of course, representative of American rather than of English conditions, but they should prove quite conclusively that small orders are relatively unprofitable. The manufacturer would realise definite savings from efforts aimed at inducing his customers to increase the size of their average order, and in many instances a careful study would indicate that price concessions on large orders would be a justifiable means to this end.

The same argument applies with equal force to the wholesaler as to the manufacturer. Valuable economies in clerical and handling costs can be realised if the number of individual orders can be reduced without affecting the total sales volume. True, the policy may be difficult to apply in certain special cases, and care must always be taken not to damage goodwill by offending the customer, but a little careful thought on the part of the individual trader should indicate ways and means whereby the desired object can be secured without any ill effects.

Domestic Electrical Appliances in Belgium

THE potential market in Belgium for household electrical appliances is worthy of consideration. Electrical energy is now supplied to over 98 per cent. of the entire country, and the number of homes not wired for electricity is fast diminishing. That such appliances have sold in limited quantities on the market in the past may be attributed largely to the adequate supply of cheap domestic help and the lack of effective distributing channels. Changes in living conditions now taking place are gradually breaking down the first of these causes, while a new class of distributors is being developed which offers potentialities that may overcome the second handicap.

The principal electrical appliances now sold in Belgium are refrigerators, vacuum cleaners, washing machines, electric irons, and floor polishers. Only a limited quantity of electric cooking utensils is sold. With the exception of washing machines, there is no local manufacture of importance, and German firms practically control the market, owing largely to their close proximity to the country, lenient credit terms, and energetic sales efforts by factory representatives. In many cases the German manufacturers have found it more advantageous to sell direct to the larger retail establishments and combination wholesale and retail outlets. Wholesale electrical supply houses have been employed to a large extent as distributors, but are reported not to have proved to be effective, because of the fact that their sales efforts are confined to the smaller electrical shops and contractors.

Little Home Manufacture

Only one Belgian firm specialises in household appliances. It manufactures a number of cooking utensils, and assembles several types of vacuum cleaners and floor polishers from parts manufactured in Germany. The greater part of the products is sold through a distributing subsidiary, which is a combination wholesale and retail concern running a number of retail shops specialising in household appliances in several of the principal towns. It also represents, on an exclusive basis, manufacturers of appliances not competitive with its lines.

Household refrigeration has only recently been introduced in Belgium, and the market, therefore, has only been slightly exploited. So far no extensive educational campaign has been undertaken expressing the many advantages and economies effected by electrical household refrigeration.

Washing machines fall within the highest competitive field, and machines of this type can now only be sold on a strictly quality basis. There are over thirty Belgian firms manufacturing washing machines, selling at prices ranging from £6 to £24. Most of the Belgian goods are sold on a strictly price basis, with little regard to efficiency, appearance, or ease of operation. The tubs of Belgian machines are mostly of wood or galvanised iron with wooden agitators. In spite of many obvious defects their low price has made them very popular. Several relatively high-priced American electric washing machines are now being sold in Belgium, and dealers report that sales have been increasing slowly but steadily.

Although one American and several Continental makes of electric kitchen ranges are being offered on the Belgian market, sales have been limited despite the fact that the cost of operation is not a serious objection to their purchase. On the other hand, no real effort has been made to bring the many advantages of electric cooking to the attention of housewives.

Smaller Apparatus

In the other heating appliance class the electric iron is the most popular item, the chief source of supply being Germany. Owing to a difference in cooking practices, there has been little demand in the past for toasters, percolators, hot-plates, &c., although the low demand is also partially due to the poor design of this type of appliance that is offered for sale. Motor-driven mixers, beaters, choppers, &c., have only recently been introduced, and very few dealers are handling them.

Practically every well-known European and American vacuum-cleaner manufacturer is represented in Belgium.

Belgian Foreign Electrical Trade

THE following table shows the Belgian imports and exports of electrical machinery, apparatus, and cognate goods during the first half of the current year, as compared with the corresponding six months of 1931, the values having been converted at an exchange rate of 125 francs to the £.

	Imports. January–June,		Exports. January–June,	
	1931.	1932.	1931.	1931.
	£	£	£	£
Dynamo-electric machinery ...	424,264	235,160	194,560	115,048
Dry batteries	18,704	12,912	13,432	904
Accumulators and parts	32,632	15,304	37,192	27,792
Magnets (other than electro-magnets)	5,272	2,248	24	72
Land and submarine cables ...	42,976	9,872	131,384	76,408
Insulated wire	54,984	28,368	167,680	92,200
Copper wire (not insulated) ...	6,832	1,064	368	2,024
Carbons and electrodes	28,704	22,480	328	512
Porcelain insulators	24,080	18,888	2,424	1,136
Electric globes and glassware ...	38,864	25,058	4,200	10,848
Insulated tubes, junction boxes, &c.	24,464	11,568	4,664	3,392
Other insulating material	25,360	17,736	480	560
Arc lamps	328	1,488	16	—
Incandescent lamps	146,808	115,848	58,264	55,128
Radio valves	76,720	84,336	—	—
Electric measuring instruments ...	104,248	77,392	4,416	3,040
Telegraph and telephone apparatus	395,984	374,968	449,352	283,992
Other electrical apparatus... ...	713,152	487,528	201,216	74,280
Totals	£2,164,376	£1,542,218	£1,270,000	£747,336

It will be seen that both sections of the trade have been seriously affected by the current industrial depression, the imports showing a decline of £622,158, or nearly 30 per cent. Sixteen of the scheduled items record a decline and two an increase, the most notable advance being in radio valves. On the export side there is a decrease of £522,664, or over 40 per cent. A noteworthy feature of the Belgian returns is that while the import trade of electrical machinery and apparatus is still of considerable importance, a very small portion of it falls to the credit of Great Britain, which, however, is a large purchaser of Belgian material, particularly cables and wire.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources, Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

Proposed Reduction of Australian Duties

In presenting his Budget on September 1st, Mr. J. A. Lyons, the Prime Minister and Treasurer of the Australian Commonwealth, announced the Government's intention of introducing a new tariff schedule providing for lower duties on a number of classes of goods, including dynamo-electric machinery. He also stated, says *Reuter*, that a further revision of the tariff programme would be undertaken as additional reports were received from the Tariff Board.

Window Publicity at Chester

The Chester Corporation's electricity showrooms in Northgate Street are always the scene of attractive displays. Our

A " Revo " window blind at the Chester showrooms

illustration shows an advertisement window blind, supplied by the Revo Electric Co., Ltd., which is drawn whenever the window display is being changed. The blind is prepared in attractive colours, and cannot fail to draw attention to the hiring terms for cookers supplied by the Corporation.

Ediswan Radio Battery Window Displays

As a part of its new season's radio battery sales campaign the Edison Swan Electric Co., Ltd., has prepared two attractive and colourful window displays for the use of dealers. Display " H.T.1.," which is suitable for windows of 9 ft. and over, has a background of dark brown, with panels of silver and orange, and a large centre piece. For windows of under 9 ft. there has been designed an equally striking display (" H.T.2 "). The background of this is in orange relieved with cinnamon centre panel and flares and tubes of silver. There is a small centre-piece and the floor is orange, cinnamon and silver panelled.

Electrical Trading at Reigate

The Reigate and Redhill Chamber of Commerce on August 30th considered the question of the opening of showrooms by the Town Council in connection with the Electricity Department, and passed a resolution for submission to the Council stating that municipal showrooms were unnecessary, as adequate showrooms were already provided by several firms in the borough. The resolution suggested that for the purpose of hiring, contractors should act as agents for the Corporation, and that the delivery of and wiring for apparatus should be undertaken by contractors at a fixed schedule of prices.

Balsa Wood

We have received from the Balsa Wood Co., Ltd., Africa House, Kingsway, W.C.2, a sample of timber of remarkable lightness—a cubic foot of it weighs only seven or eight pounds; the weight of cork is 11-13 lb. per cu. ft. This wood, known as Balsa wood, is found in Central and South America; attempts to grow it elsewhere have failed. Among its qualities is a low thermal conductivity making it suitable for refrigerating or heating apparatus. It is also employed in the soundproofing of rooms, electric motors, &c.

Glasgow Electricity Department's Offices

Work will be completed shortly on the reconstructed head office of the Glasgow Corporation Electricity Department at 75, Waterloo Street. The existing showrooms of the Department in Sauchiehall Street will then be closed down, and on the ground and basement floors of the new building will be accommodated a suite of display salons, while spacious windows will provide for the exhibition of a wide range of electrical appliances. The upper floors will be occupied by the offices of the Department. The work has cost over £50,000. A deputation from the Electricity Committee is at present visiting Newcastle and Bradford for the purpose of inspecting the Corporation showrooms and the staffing arrangements there.

Bakelite Developments

Bakelite, Ltd., has recently enlarged its plant for the manufacture of " Bakelite " laminated sheet materials at its new works at Tyseley, Birmingham, and sheet materials 84 in. long by 36 in. wide are now being produced. Sheets from 0.004 in. thick (weighing a little over ½ lb.) to sheets 4 in. thick (weighing 600 lb.) can be produced. This plant is also used for producing " Bakelite " laminated sheet for decorative purposes.

An Inquiry from Canada

The Officer-in-Charge of H.M. Trade Commissioner's Office at Winnipeg reports that he has been approached by a firm manufacturing storage batteries in Western Canada regarding its desire to receive quotations from United Kingdom firms for the following lines: Antimony, battery boxes and covers, battery sealing compound, hydrometers, lighting plant battery glass jars, battery oxides (red lead and litharge), rubber nuts, hard rubber rods (⅛ in. and ¼ in.), battery separators dry (wooden battery partitions), perforated rubber separators and soft rubber vent plugs. Further details can be obtained upon application to the Department of Overseas Trade, 35, Old Queen Street, S.W.1, quoting reference C.X. 3980.

The Birmingham Electric Club

The Birmingham Electric Club will hold its annual " ladies' evening " on Friday, October 14th at the Grand Hotel, Birmingham. Tickets (12s. each, including supper) may be obtained by applying, not later than October 7th, to the hon. social secretary, Mr. W. E. Clark, " Mylor," Warwick Road, Solihull, Warwickshire.

Birkenhead and Electrical Wiring

The Birkenhead Electricity Committee has recommended the Town Council to approve a proposal that wiring work shall be carried out by registered electrical contractors only. This is not a unanimous recommendation, and probably will give rise to a discussion at the Council meeting.

Trade Visits to India

Sir Thomas Ainscough, H.M. Senior Trade Commissioner in India and Ceylon, and his colleagues—Mr. W. D. M. Clarke, H.M. Trade Commissioner at Bombay, and Mr. R. B. Willmot, H.M. Trade Commissioner at Calcutta—are desirous of meeting commercial visitors from the United Kingdom, as they feel that they are in an excellent position to assist in developing the sale of goods of United Kingdom manufacture in India. The Department of Overseas Trade will accordingly be pleased to provide representatives of firms contemplating visiting India, with letters of introduction to the Commissioners in question, and, in addition, an officer of the India Section of the Department in London will be pleased to discuss proposed trips with a view to rendering any assistance possible.

Conditions in Syria

A Department of Overseas Trade report on economic conditions in Syria states that the effects of the general world depression were felt there later than elsewhere but that matters are now in a bad state. Credit is severely restricted and it is difficult to sell commodities at remunerative prices. Since the United Kingdom abandoned the gold standard British prices have once more become competitive and the flow of goods is increasing. Of electrical machinery and apparatus imports in 1931 valued at 71,972,696 piastres, the United Kingdom's share amounted to only 1,531,173 piastres, France being responsible for the largest portion of the trade (30,225,940 piastres). At Aleppo there are signs of a move towards a higher standard of comfort and there is a growing demand for electrical and radio equipment.

Switchgear Manufacture in Australia

During an inquiry by the Australian Tariff Board into the duties on electrical switchgear it was stated on behalf of the New South Wales manufacturers that the capital employed in the local manufacture of switchgear was £233,155, and that the value of the output was £154,544 per annum. The Board was inquiring into the necessity for continuing the increased rates of duty imposed on May 3rd. These rates are 65 per cent. British preferential, 70 per cent. intermediate, and 75 per cent. general. The previous rates were 35, 45, and 50 per cent. respectively.

The Belgian Radio Market

The present appears to be a good opportunity for the marketing of radio apparatus in Belgium, last year approximately 110,000 receivers being imported into the country, according to an estimate quoted in a Department of Overseas Trade report on the subject. United Kingdom radio manufacturers in general appear so far to have made no serious effort to capture any considerable part of the trade, only 1,500 British sets being

imported in 1931. The increasing enthusiasm for radio, the decline in the popularity of the American set, the high reputation of British goods and the present favourable rate of exchange are factors which should facilitate the penetration of the market by British manufacturers; a proposed increase in import tariffs may, however, affect the position.

German Electrical Imports and Exports

The official returns show that the imports of electrical machinery and apparatus into Germany during the six months ended June last amounted to £595,000 as compared with £917,800 in the corresponding period of 1931. The exports of similar material from Germany during the six months amounted to £8,732,200, the latter figure comparing with £11,480,150 in the corresponding period last year. The import total was made up of £92,400 of electrical machinery, and parts and apparatus £582,600. The respective figures for the exports were £2,226,150 and £6,506,050.

Conditions in Finland

A report on the economic situation in Finland just issued by the Department of Overseas Trade says that the country has a strong desire to buy from the United Kingdom, and during the past few months the proportion of imports from Great Britain has been greater than for many years. Nevertheless, during the first half of this year electrical machinery imports totalled only 409 tons, which compares with 549 tons in January-June last year.

Hungarian Foreign Electrical Trade

According to the *Board of Trade Journal*, imports of electrical machinery and apparatus during the first half of the current year amounted in value to 1,989,000 pengö, as compared with 3,874,000 pengö in the corresponding period of 1931. Exports of similar materials declined from 10,345,000 to 8,651,000 pengö in value.

The Czechoslovakian Lamp Trade

The manufacture of electric lamps in Czechoslovakia is of comparatively recent date, but exports already exceed imports. In the first half of this year 4,800,000 lamps valued at Kc. 10,200,000 were exported, compared with 3,680,000 valued at Kc. 10,600,000 in the corresponding months of 1931. Imports totalled 2,500,000 lamps valued at Kc. 8,400,000 as against 2,010,000 valued at Kc. 9,000,000 in the first half of 1931. The main destinations of the exports were: Argentina, 885,000, valued at Kc. 2,600,000; France, 625,000 (Kc. 900,000); India, 200,000 (Kc. 800,000); Holland, 207,000 (Kc. 700,000). Imports came in mainly from: Austria, 703,000 (Kc. 3,000,000); Holland, 541,000 (Kc. 2,700,000); and Germany, 645,000 (Kc. 1,900,000).

Social Events

Last Saturday began with leaden skies and a continuous downpour but by 2 o'clock, when the "Clesco" sixteenth annual horticultural exhibition and garden party opened at Raynes Park the rain had stopped completely. The programme included an excellent show of garden produce grown by em-

Lady Renwick presenting the Sir Harry Renwick Challenge Cup to the winners

ployés as well as a number of entertainments and humorous races. Callender's Band provided music during the afternoon and for the open-air dancing later in the evening. The attendance was rather low at the opening owing to the weather but by the evening there was a goodly assembly.

Catalogues Required

Mr. F. R. Ashton has commenced business as an electrical engineer at 61, Humberstone Road, Cambridge, and asks for catalogues and showcards from factors and manufacturers of installation, radio and automobile electrical equipment.

French Import Duties

The *Board of Trade Journal* announces the introduction by the French Government of an import duty of 22 per cent. *ad valorem* on radio apparatus with gramophone pick-ups. Various tariffs have also been introduced relating to electric lighting equipment for cycles and motor-cycles.

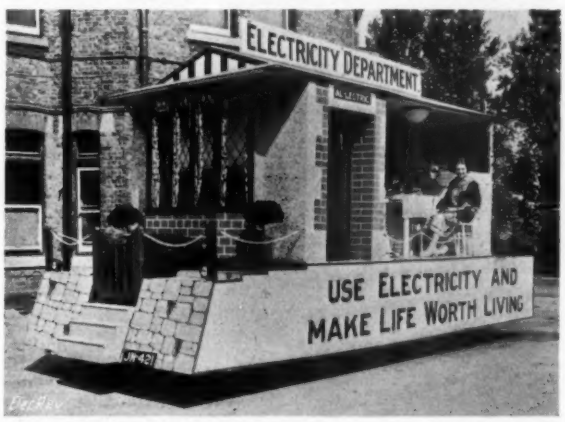
For Sale

The Midland Iron & Hardware Co. (Cradley Heath), Ltd., has a quantity of electrical plant for disposal.

(See our advertisement pages to-day.)

Carnival Celebrations at Southend-on-Sea

Below is to be seen a picture of the Southend-on-Sea Electricity Department's Carnival car mentioned in our last issue (page 338). The car was constructed in the form of a miniature all-electric house and bore a notice inviting spectators to "Use



Southend Electricity Department's attractive Carnival car

electricity and make life worth living." In the small space available there were shown a kitchen, a dressing room and a bathroom, all fully equipped with the latest electrical appliances. An attractive feature was the use of low-pressure neon tubing for illuminating the nameplate over the front door and lighting the eaves and gables.

New Electrical Showrooms

The Electrical Distribution of Yorkshire, Ltd., has opened new electrical showrooms at 55, Wharf Street, Sowerby Bridge.

Russian Electrical Development

At the beginning of May last manufacturing operations were commenced at the extensive works of the Volkhov Aluminium Combine near Leningrad. Its capacity is 12,000 tons of aluminium per annum, to be obtained exclusively from home materials, including the Tikhvin bauxites by means of electrical furnaces. The Combine will develop four different branches of production: (1) artificial creolite, (2) electrical anodes for electrolysis, (3) the working up of alumina, and (4) the output of metallurgical aluminium by electrolysis.

Austrian Import Restrictions

According to the *Board of Trade Journal*, the Commercial Councillor to H.M. Legation at Vienna reports the issue of two Government decrees which subject a further list of goods to the system of import licences instituted in April last. The goods affected include lead-covered electric cable and electric accumulators (other than pocket accumulators) and plates therefor.

Trade Announcements

Messrs. W. C. Davey & Co. are moving on Monday next to new premises at 176, Tottenham Court Road, W.1. Their telephone number remains unchanged.

The United Electrical Co. (Birmingham), Ltd., has altered its name to the United Electrical Co. (Coolex), Ltd., in order to emphasise that it is the maker of "Coolex" switch and fuse gear.

Mr. F. Lovell Harris, electrical and radio engineer, late of Castle Street, Trowbridge, announces that he is carrying on business temporarily at Bradwood, Bradley Road.

Messrs. Baxter and Caunter, Ltd., have opened a trade counter and well-equipped stores as well as a show and demonstration room at 33-37, Alfred Place, W.C.1.

The Normand Electrical Co., Ltd., announces that its office entrance for callers has been changed to 35, Macaulay Road, S.W.4, round the corner from the present entrance.

Messrs. Wolf & Williams, 53, Victoria Street, S.W.1, have been appointed sales representatives for England and Wales for the Croydon Engineering Co., Ltd., designers and manufacturers of fractional horse-power motors.

The Mercury Switch Manufacturing Co., Ltd., is now manufacturing "Muth" mercury switches in this country, and a full range of switches is now in production.

The Brighton Electrical Exhibition

An electrical exhibition is to be held at the Dome and Pavilion, Brighton, from September 14th to 24th. The Henderson Electrical and Wireless Service informs us that it is exhibiting all the leading makes of electrical and radio appliances.

Recent Contract

Messrs. Blackstone & Co., Ltd., have received an order for the supply of sludge pumping equipment for the Gravesend sewage disposal works. The order comprises eleven sets of electrically driven "Blackstone" unchokeable sludge pumps, controlled by both automatic and hand-operated starters. The whole contract, which includes the supply and fixing of pipes, valves and wiring complete, is valued at approximately £3,500.

New Indian Power Company

Our Indian Correspondent reports that a company with the title of the Malabar Electricity Co., Ltd., has been registered in Madras, with an authorised capital of Rs. 10 lakhs, for the purpose of electrical development in the Malabar district.

A new showcard in colour just issued by Carron Company for the coming season

Success of Radio Exhibition

An announcement made by Mr. Richard Haigh, English manager of H.M.V., confirms the general statement issued by the Radio Manufacturers' Association concerning the large amount of business done at the Radio Exhibition at Olympia. Mr. Haigh stated that as orders had exceeded their expectations they had decided to increase their autumn production schedule, and consequently were able to announce price reductions for three of their instruments, by reason of the fact that these are housed in the same type of cabinet, thereby effecting a further saving in production costs. The increased business has resulted in the employment of over a thousand additional workers at the Hayes factories, bringing the total number to over 8,000.

Bavarian Electrical Amalgamation

The Frankfort correspondent of the *Financial Times* states that the fusion is announced of three leading Bavarian electrical companies, the Amperwerke Elektrizitäts-A.G., the Neue Amperkraftwerke A.G. and the Ober-Bayerische überland-Zentrale A.G., all of Munich. A joint statement issued states that the companies are amalgamating in order to simplify their management and rationalise their works.

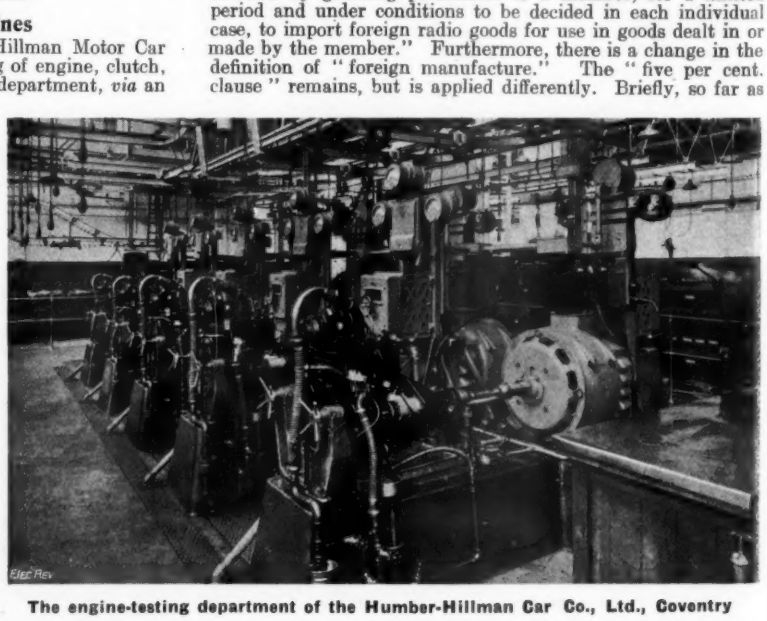
Testing Automobile Engines

At the Coventry works of the Humber-Hillman Motor Car Co., Ltd., assembled power units (consisting of engine, clutch, and gear box) are received into the testing department, *via* an overhead conveyor track, and are lowered and raised by compressed air equipment on to ten test beds. Water, oil, and petrol supplies are then connected up, and the engines coupled to 20-h.p. electric motors.

Each engine is first "motored" without ignition, and then arranged to drive the electric motor as a generator on increasing load.

Ten of these electrical testing sets are installed. They were manufactured and supplied by the General Electric Co., Ltd., and each set consists of a 17-kW 460-volt d.c. machine running at 1,000-2,500 r.p.m., controlled by a switchboard comprising a triple-pole ironclad switch and fuse, motor starter fitted with no-volt and overload releases, shunt field regulator electrically interlocked with the starter, central zero ammeter for reading the load when the machine is generating, and a voltmeter and ammeter for indicating the power required to drive the engine.

The d.c. machines are fitted with a light counter-compound winding for stability, and are also equipped with a mechanical overspeed device which not only trips the motor starter, so disconnecting the machine from the line, but also breaks the engine ignition circuit, thus completely shutting down engine and motor.



The engine-testing department of the Humber-Hillman Car Co., Ltd., Coventry

Electrical Production in America

No indication of any general improvement is yet apparent in the statistics published in the *Survey* of the National Electrical Manufacturers' Association relating to the production of its various members during June. As compared with June, 1931, orders for a.c. electric motors (1-200 h.p.) at $758,106 were $926,225 lower, the demand for d.c. motors (1-200 h.p.) also declining from $402,130 to $169,691; fractional h.p. motor orders stood at $859,086, as against $2,204,637. The position in the power switching equipment market remains as bad as ever, only $70,390 worth of orders being on hand as compared with $292,779. The figures relating to electric furnaces ($116,474), however, show a marked improvement and actually surpass the June, 1931, figure by $5,840.

Under-water Bath Lighting

In connection with the note in our August 26th issue (page 297), relating to the special system of under-water lighting at the Mile End Baths, Messrs. Barlow Bros. & Co. inform us that they were the electrical contractors and carried out the whole of the wiring and installation work for the lighting and power requirements of the building. A photograph showing the new lighting is reproduced herewith.

Great success has attended the installation of under-water lighting at the Mile End Baths

Revision of the R.M.A. Constitution

A revised and considerably simplified version of the Constitution of the Radio Manufacturers' Association was unanimously agreed to at a recent extraordinary general meeting, says the *Wireless & Gramophone Trader*. The decision has yet to be confirmed by a postal vote, but in the meanwhile it is possible to outline the most important changes that have been made. Under new regulations relating to membership, applicants must declare (*a*) the apparatus they propose to manufacture, (*b*) that the apparatus is not of foreign manufacture, and (*c*) their qualification for membership. The rules relating to the importation of foreign goods have also been revised, and in future "a member may not deal in, or embody in his sets, any radio apparatus of foreign manufacture if similar goods are included in the Association's 'Official Schedule,' provided that the Council may in its discretion relax this prohibition by granting permission to a member, for a limited period and under conditions to be decided in each individual case, to import foreign radio goods for use in goods dealt in or made by the member." Furthermore, there is a change in the definition of "foreign manufacture." The "five per cent. clause" remains, but is applied differently. Briefly, so far as concerns other than complete instruments, it means that products will be classed as of "foreign manufacture" if they embody foreign parts the purchase price of which exceeds 5 per cent. of the full retail list price of the whole article. For receivers and radio-gramophones, however, the 5 per cent. has now to be considered as a proportion of the retail list price of the "chassis or operative mechanism forming a part of the whole marketed apparatus."

Prices of Materials

Messrs. F. Smith & Co. report, September 7th: Electrolytic copper bars, sheets and wire rods, no change. Electrolytic copper h.c. wire, 7d., ¾d. inc. Silicium bronze wire, 8d., 3/16d. inc.

Messrs. Edward Till & Co. report, September 7th: India-rubber, Para fine, 5¼d., ¼d. inc.

Messrs. James & Shakespeare report, September 7th: Copper bars (best selected), sheet and rod, £68, English pig lead, £16, £1 inc.

New Catalogues and Lists

Normand Electrical Co., Ltd., 3, North Side, Clapham Common, S.W.4.—A price list (No. 832) dealing with "Neco" low-speed motors.

A.E.G. Electric Co., Ltd., 131, Victoria Street, S.W.1.—A booklet giving details of the type "F.S." two-part tariff prepayment meter.

Radiovisor Parent, Ltd., 28, Little Russell Street, W.C.1.—Leaflets describing the "Radiovisor" bridge, lighting and general-purpose units, and industrial smoke indicators.

Fuller Accumulator Co. (1926), Ltd., Woodland Works, Chadwell Heath, Essex.—An illustrated folder (No. D.W. 3) dealing with accumulators and dry batteries for radio and other services.

H. J. Baldwin & Co., Baldwin House, Nottingham.—An illustrated catalogue dealing with cable covers, ducts and troughing.

Dubilier Condenser Co. (1925), Ltd., Victoria Road, North Acton, W.3.—A booklet on power factor correction condensers.

R. F. Winder, Ltd., Belgrave Electrical Works, Leeds.—The September list of surplus, new and second-hand electrical material.

Maurice Bobin, 15, Farringdon Avenue, E.C.4.—An illustrated leaflet relating to "Embob" table and floor standard lamps.

Sir W. G. Armstrong-Whitworth & Co. (Engineers), Ltd., Scotswood Works, Newcastle-upon-Tyne.—A 64-page illustrated brochure containing particulars of the company's numerous and varied products.

A. Reyrolle & Co., Ltd., Hebburn-on-Tyne.—Pamphlet No. 361, describing the "Reymez" pedestal wash-basin, with a self-contained electric water heater.

Erskine, Heap & Co., Ltd., Lancashire Switchgear Works, Caroline Street, Broughton, Manchester.—Pamphlets A.B. 10 and I. 24 giving particulars of two new products—a new small air break a.c. starter and a 2½-in. scale ammeter for use with starters up to 100 A.

Fry's (London), Ltd., 24/25, King Street, E.1.—Particulars of the new "Enox" pocket saw No. 28.

Igranic Electric Co., Ltd., 149, Queen Victoria Street, E.C.4.—A leaflet (No. 1015) on across-the-line automatic reversible motor starters.

Francis Polden & Co., Ltd., 56, Cannon Street, E.C.4.—A folder dealing with the "Pneumode" vacuum cleaner.

Pope's Electric Lamp Co., Ltd., 5, Arthur Street, New Oxford Street, W.C.2.—A folder (No. 6269) containing prices and full details relating to "Elasta" lamps.

M. & C. Switchgear, Ltd., Kelvinside Works, Kirkintillock, Glasgow.—Pamphlets G.11/3 and K.81/1 dealing respectively with disconnecting link boxes and metal-clad oil circuit breakers.

Concordia Electric Wire Co., Ltd., New Sawley, near Nottingham.—A price list of "Concord" radio wires, cables, flexibles, &c.

Richardsons, Westgarth & Co., Ltd., Hartlepool.—An illustrated brochure relating to Richardsons Westgarth-Brown Boveri turbo-alternators.

Matterson, Ltd., Healey Works, Shawclough, Rochdale.—A leaflet (catalogue section 12) on infinitely variable speed gear and motor combinations.

Murex Welding Processes, Ltd., Ferry Lane Works, Forest Road, E.17.—A booklet entitled "Arc Welding on Tramways."

General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—The August issue of the "Osram G.E.C. Bulletin," containing an interesting article on "Modernising Hotels by Light."

Bastian & Allen, Ltd., 14, Church Road, Hanwell, W.7.—A leaflet on "Bastian" electric water heaters.

A. W. Bouttell, Ltd., Victoria Street, S.W.1.—The new season's lists of "Linolite" strip reflector products for showcase, shop window, picture and cornice lighting, &c.

Sun Electrical Co., Ltd., 118 and 120, Charing Cross Road, W.C.2.—A comprehensive catalogue (112 pages) devoted entirely to radio receivers and radio-gramophones. Two complete pages are used to describe each model, the aim being to give a dealer a catalogue which can be shown to his customer with the confidence that each set will have individual attention.

Radio Instruments, Ltd., Purley Way, Croydon.—A complete catalogue of "R.I." components and receivers, together with illustrated leaflets on the "Madrigal" and new superheterodyne receivers and the "Parafeed" coupling unit.

John Shaw & Sons, Wolverhampton, Ltd., Wolverhampton.—The new season's catalogue of "Trojan" electrical appliances containing particulars of several new lines.

Geo. Becker, Ltd., Northend Road, Wembley.—Leaflets describing the "Becker" bell pushes and connectors and electrical apparatus, and the "Beckerlite" lamp.

A. F. Bulgin & Co., Ltd., Abbey Road, Barking.—Catalogue No. 152 giving details of the complete range of "Bulgin" radio products. Included in the 80 pages is a quantity of technical information with diagrams showing the correct way to wire up various components.

Bankruptcy Proceedings

M. Tinner (Yorkshire Trading Co.), electrical factor, 91, Porter Street, Hull.—First meeting September 14th, at the Official Receiver's office, 37, Scale Lane, Hull. Public examination, October 24th, at the Guildhall, Alfred Gelder Street, Hull.

J. E. Roberts (trading as Roberts & Goldthorpe), engineer and electrician, Crosland Moor Mills, Huddersfield.—Last day for receiving proofs for dividend September 13th. Trustee, Mr. H. N. Bostock, Union Bank Chambers, Huddersfield.

Company Liquidations

A. S. Griggs & Co., Ltd., radio and electrical engineers, 7, Burnley Road, Dollis Hill, N.W.10.—The statutory meeting of creditors was held recently when it was reported that the liabilities totalled £1,109, and the assets included stock (£287), motor car (£80), and sundry debtors (£513). The present position was attributed to the failure of a wireless set which was manufactured and to the general trade depression. The creditors resolved that Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C., should be appointed liquidator with a committee of inspection.

The Western Wireless & Electrical Co. (Salisbury), Ltd.—Winding up voluntarily. Liquidator, Mr. J. R. Layton, Crown Chambers, Salisbury.

Mossops (London), Ltd.—Meetings, September 27th, at Salisbury House, E.C.2, to receive an account of the winding up by the liquidator, Mr. F. F. Sharles.

Hamley Bros., Ltd.—Meetings, September 27th, at the offices of Messrs. Francis Nicholls, White & Co., 73, Cheapside, E.C.2, to receive an account of the winding up by the liquidator, Mr. A. Granville White.

Reliable Trading Co., Ltd.—Mr. C. A. Dodds, Finsbury Pavement House, Moorgate, E.C.2, was appointed liquidator on August 12th, with a committee of inspection.

Winding-up Petition

Ward Electrical Co., Ltd.—A petition for the winding up of this company has been presented to the High Court and will be heard in London on October 17th.

Deed of Assignment

G. Phillips and **F. Dart** (trading as Phillips & Dart), electrical engineers, 3, Rivoli Buildings, Chapel Road and 55, Victoria Road, both Worthing.—Particulars of claims by September 28th to Mr. W. Nicholson, 12, Wood Street, E.C.2.

The sign illustrated above was put into operation outside the "Tivoli," Strand, W.C., by Boro' Electric Signs on Monday last. It contains over 1,000 ft. of 14/15 mm. multi-coloured "Boro' Neon" tubing and twenty-four transformers to give a pressure for the entire display of 5,000 V. The action is in three parts; the tiger crouching, springing, and then leaping through the palms in the top left-hand corner, while the crocodile snaps his jaws. Finally, "Frank Buck's Bring 'Em Back Alive" is flashed across the sign

Dissolution of Partnership

Northern Radio Exchange Co., 148a, Trafalgar Street, Burnley.—Messrs. J. C. Harrison and H. Hastwell have dissolved partnership. Mr. Hastwell will attend to debts and carry on the business.

Private Arrangements

Boyce Bros., Ltd., electrical engineers, 52, High Street, Highgate, N.19.—An adjourned meeting of creditors was held on August 31st at the Institute of Chartered Accountants, E.C. An amended statement of affairs was submitted which disclosed liabilities of £835, while the assets were estimated to realise £439. From this had to be deducted £148 for preferential claims, leaving net assets of £291, or a deficiency of £544. Mr. J. Quinn, the secretary of the company, said that the committee of inspection appointed at the last meeting recommended that in view of the position of the company steps should be taken to pass the necessary resolutions for voluntary liquidation.

D. R. Williams (trading as D. R. and L. R. Williams), electrical contractor, 110, John Street, Porthcawl, and Sterry Road, Gowerton.—A meeting of creditors was held recently, when the representative of Siemens Electric Lamps & Supplies, Ltd., occupied the chair. A statement of affairs prepared by Messrs. J. Wallace Williams & Co., Cardiff, was submitted, which disclosed liabilities of £785, of which £540 was due to the trade. The debtor was questioned at some length with regard to an offer and he stated that although he was not in a position to submit a proposal at the present time he was anxious to continue the business if possible. The matter was discussed and it was resolved that a deed of assignment which had already been executed in favour of Mr. J. W. Williams as trustee should be confirmed, and that the debtor should be given seven days within which to submit an offer which would be approved by a committee of inspection consisting of the representatives of three of the creditors. The following are the principal creditors: British Insulated Cables, Ltd., £75; Callender's Cable and Construction Co., Ltd., £51; R. Eggleston, £80; General Electric Co., Ltd., £150; Siemens Bros. & Co., Ltd., £150.

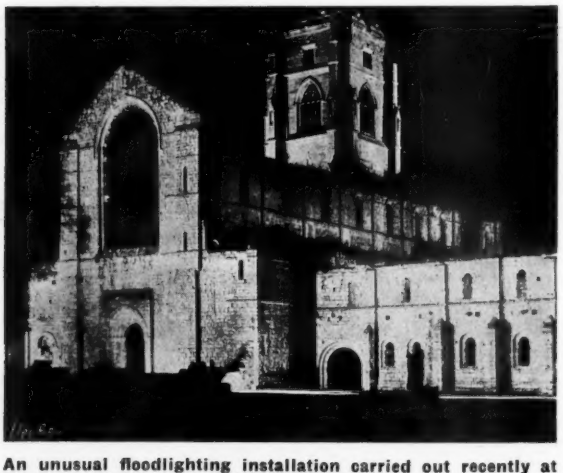
Electricity Supply

Lighting, Domestic, Power

Australia.—REGISTRATION OF ELECTRICAL CONTRACTORS.—*The Electrical Engineer and Merchandiser* states that the South Australian Contractors' Association is pressing for the introduction of legislation for the registration of electrical contractors and the licensing of electricians. South Australia is the only State in the Commonwealth which does not possess such provisions.

SYDNEY.—The Electricity Department has introduced a special charge of 1¼d. per kWh for electricity used for outdoor floodlighting.

Ayrshire.—OFFER TO PURCHASE UNDERTAKING REJECTED.—The Ayrshire Electricity Board at a meeting held in Kilmarnock on Friday, definitely rejected the offer of the Power Securities Corporation, Ltd., for the purchase of the Ayrshire electricity undertaking. It was stated that the sum offered for the undertaking, inclusive of all assets, was £1,550,000. The outstanding loan debt on the electricity undertaking is £1,382,915, so that after the Board had met its loan obligations the proposed purchase price would apparently have left it with a surplus of £167,805, representing payment for goodwill. This surplus, however, would be subject to certain deductions which would probably reduce it to about £150,000. Against this surplus, however, there have to be set the reserves possessed by the Board. According to the terms of the offer, these reserves were to be transferred along with the other assets of the Board, and were covered by the proposed payment of £1,550,000. The Board's actual reserves amount to £112,328, and in addition there are reserve equivalents which are not included in the nominal capital value of the undertaking. These reserve equivalents represent expenditure incurred in the promotion of Parliamentary Orders, in connection with the change of pressure, in the purchase of hiring apparatus, and on unemployment grants, and total approximately £88,000. Thus the value of the total reserves and reserve equivalents of the Board is roughly about £200,000, and these, it is contended, must be taken into consideration in arriving at the actual capital value of the undertaking. If that is done it will be seen that the offer of £1,550,000 for the whole undertaking is some £50,000 less than its capital value, and the acceptance of the offer would have represented an actual loss to the Board and its constituent authorities, instead of ensuring them a commensurate profit for goodwill. It is worthy of note, too, that under the terms of the offer, the net surplus after the discharge of loan debt obligations was not to be handed over to the constituent authorities of the Board. It was the intention that the surplus should be placed in a special fund by the purchasing company and applied by it for the benefit of consumers over a period, either by reduction of charges or in any other manner that might be agreed upon by the purchasing company and the Board. These, it is believed, were some of the considerations which weighed with the Board in coming to the



An unusual floodlighting installation carried out recently at Fountains Abbey by the Edison Swan Electric Co. Altogether 90 " Mars " and " Mazdalux " projectors were used

decision that the sum offered was inadequate. Further, it was realised that the taking over of the undertaking on these terms would result in an increase in the standing charges of the undertaking of from £40,000 to £50,000 a year, and the Board was not satisfied that the economies in operative costs to be effected through rationalisation, or the merging of the undertaking in a large group of similar concerns, would be commensurate with the increased capital charges. There was thus every prospect that in due course a material increase would have to be made in the rates payable by Ayrshire consumers of electricity, with consequently adverse effects on the industry of the county.

Blackpool.—PRIZES FOR PRIVATE ILLUMINATIONS.—In connection with the annual illuminations which commence towards the end of this month, £100 is offered in cash prizes for the best private illumination displays. Boarding-house keepers and others are provided with facilities for the hire of coloured strip lighting at small charges and may engage local electrical contractors to do the necessary installation work.

Bognor Regis.—CHEAPER ELECTRICITY.—A reduction in the lighting charge has been made by the Bognor Gas and Electricity Co. (electrical engineer, Mr. H. A. Harding) in the parish of Middleton to 7d. per kWh and in the borough of Arundel to 8d. per kWh. A two-part tariff has also been adopted for all areas, based on the maximum demand plus 1½d. per kWh.

Bolton.—NEW SUB-STATION.—The Electricity Committee is to erect a sub-station in Milk Street.

Burnley.—SPECIAL LIGHTING CHARGES.—The Electricity Committee recommends the reduction of the charge for electricity for lighting or cinematograph purposes between 11 p.m. and sunset from 2½d. to 2d. per kWh, the consumer to pay the cost of a special time-switch to be installed on his premises.

MAINS EXTENSIONS.—The Electricity Department has received sanction to a loan of £25,000 for mains and services. Mains extensions are to be carried out at a cost of £640.

Canada.—THE BEAUHARNOIS POWER SCHEME.—It is announced that the Beauharnois Power Corporation will be in a position to begin to deliver power to the Ontario Hydro-Electric Co. and the Montreal Power Co. on October 1st in accordance with the terms of its contract with these two companies. The Beauharnois concern is installing 500,000 h.p. of hydro-electric plant. —*Reuter* (Ottawa).

Chelmsford.—OVERHEAD LINES.—The Town Council is to oppose the application of the Electric Supply Corporation, Ltd., to erect overhead lines in various districts.

Continental.—RUSSIA.—The construction of a large hydro-electric station has been begun near Tashkent in Russian Turkestan. The power is to be used for the production of nitrogen from the air and other processes for which great quantities of cheap power are required. The scheme, which is expected to take three years to carry out, includes the construction of a dam and storage reservoir, a canal nearly sixteen miles long and two power stations capable of developing together a total of 280,000 kW.—*Reuter* (Moscow).

The American engineers who have been acting in a consultative capacity in connection with the Dnieprostroy hydro-electric scheme have left Moscow and the works have now been officially taken over by the Soviet Government. The hydro-electric station, which involved the erection of one of the largest dams in the world, measuring nearly half a mile, across the Dnieper, is planned for an output of 3,000,000,000 kWh annually when completed next year, and a full capacity of 810,000 h.p., of which 450,000 h.p. has already been installed. Work at Dnieprostroy was begun in 1927.—*Reuter* (Moscow).

FRANCE.—At the beginning of this year only 6,299 of the 38,004 communes in France, representing a population of 2,531,165 or about seven per cent. of the total population, were not supplied with electricity. All the communes in the departments of Loire-Inférieure, Loiret, Bas-Rhin, Seine and Vienne, were electrified, and eight others were almost in the same position; in 1919 only 6,000 communes were supplied with electricity. According to Government statistics just completed the output of public generating stations totalled 15,339 million kWh in 1930, 8,463 million kWh being produced at thermal and 6,876 million at hydro-electric stations. The output has doubled since 1923, and it is estimated that the consumption per inhabitant amounts to 332 kWh. In 1930 there were 100 systems distributing more than 20 million kWh, and the total power installed was 7,921,000 kWh.—*Reuter's Trade Service* (Paris).

India.—FURTHER MADRAS SCHEMES.—While the construction of the Pykara project is in progress, further hydro-electric power schemes are being investigated in Madras. Field work was confined last year to the Mukurti dam foundations and the Periyar project. The investigation of the first scheme is necessary for the next stage of the Pykara development scheme, and the results so far are said to be encouraging. As regards the Periyar project, detailed investigations were made for the regulating reservoir dam and power tunnel headworks and controls, tunnel, surge shaft, auxiliary power plant, and camp sites. Special exploration had to be made for a suitable power house foundation at a level at which the full head could be utilised. As a result, the scheme is likely to be started earlier than expected.

THE KOLAB HYDRO-ELECTRIC SCHEME.—The Kolab scheme in the Vizagapatam district has also been investigated, but as the scheme will be in the new Oriya Province, it is not likely to be developed in the near future. A preliminary report upon the Kumbar scheme is also available, and it appears that the development of this scheme will have to await more prosperous times.

ELECTRICITY FROM PYKARA.—Meanwhile surveys of districts, &c., are in progress in connection with the consumption of energy from the Pykara project. The Government has sanctioned the construction of an 11-V line to Palghat, and distribution in the town will be undertaken by a private licensee, a bulk supply being taken from the Government. The erection of distribution lines in the towns of Erode and Salem has been completed, and these will begin to take supplies

shortly. Specifications have been prepared for the Coimbatore-Pollachi-Iverpadi line in the Annamalais, and work is expected to be completed by the end of October. The rural areas around Coimbatore, Mettupalaim and Karamadai are for the present included in the Government l.p. distribution scheme. Preliminary power demand surveys have been conducted in Madura, Virudhunagar, Thivkashi, Tanjore, and a large number of other towns. These places are likely to be covered by the Periyar scheme.

Liverpool.—ASSISTING WIRING PROGRESS.—During last month the Electricity Department received nearly 350 applications for facilities under the assisted wiring scheme, bringing the total to approximately 3,000.

Lydford.—PUBLIC LIGHTING.—The ratepayers have decided to adopt electricity for public lighting.

Manchester.—REPLACEMENT OF BOILERS.—The Electricity Committee has obtained sanction to a loan of £75,000 for replacement of boilers in Stuart Street.

Northern Ireland.—ARMAGH.—The Urban District Council has accepted the terms of the Northern Ireland Electricity Board for the public lighting of the town. The cost will be £200 a year less than when the Council was using electricity from its own station.

Oxford.—OVERHEAD LINES AGREEMENT.—After two years of discussion a scheme said to be completely satisfactory to all parties concerned has been agreed upon for the bringing of overhead lines into Oxford. The route of the lines into the city from Hen Wood will be *via* Chilswell Farm and along a valley parallel to the one formerly chosen but farther west, the Thames being met a little lower down. The lines will then be taken by the river into the outskirts of the city.

Plymouth.—LOANS SANCTIONED.—The Electricity Committee has obtained sanction to the borrowing of £1,050 for sub-station buildings and £2,960 for sub-station equipment.

Rawtenstall.—ALL-ELECTRIC HOUSES.—The success of its experiment in equipping municipal houses exclusively with electricity for lighting and domestic purposes has prompted the Town Council to decide to make the houses at Hall Carr all-electric also.

Sheffield.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £2,000.

South Shields.—OVERHEAD LINES OBJECTION WITHDRAWN.—The Rural District Council's objection to the erection of overhead lines in certain streets in Boldon Colliery has been withdrawn following the receipt of a letter from the County of Durham Electrical Power Distribution Co., Ltd., stating that owing to the high additional cost it was impossible to place the lines underground.

Sunderland.—OVERHEAD LINES INQUIRY.—The Ministry of Transport has conducted an inquiry into protests made by residents in the Ford area against a proposal of the County of Durham Electric Power Supply Co. to erect overhead lines in certain streets at Ford. It was complained that the poles would spoil the amenities of the village. Mr. E. N. Robinson, solicitor for the Newcastle-upon-Tyne Electric Supply Co., Ltd., stated that there was nothing in the amenities of the village which would be spoiled by the poles. To be able to give the supply the company must give it economically, and the cost of an overhead system was £312 against £694 for an underground system. The inspector (Mr. Gordon Tucker) stated that every street must be considered on its merits. His decision will be announced later.

Torrington.—LIGHTING OF THE INSTITUTION.—The Guardians' Committee has appointed a committee to consider the question of lighting the institution by electricity instead of oil.

Tow Law (Co. Durham).—OBSTACLES TO SUPPLY SCHEME.—A meeting of the Urban District Council was held recently to discuss the proposals of the Cleveland and Durham County Electric Power Co. with regard to the lighting of the town. After more than two hours' discussion no decision was reached. The Council has asked the power company to extend its network to outlying districts, but Mr. Lennox (commercial representative of the company), who attended the meeting, pointed out that it would be a costly matter to extend the company's network to the districts mentioned and then introduce the free-wiring system, unless the Council would allow the company to control the street lighting also. The matter is to receive further consideration.

Uppingham.—CABLE LAYING.—The Rural District Council has been informed that cables are to be laid from Manton, Wing and Preston to Uppingham.

Uttoxeter.—SPECIAL ORDER APPROVED.—The Rural District Council has received from the Electricity Commissioners an intimation that they have approved the Rugeley and District Special Order authorising the supply of electricity to Abbots Bromley.

Traction

Australia.—FUTURE OF TRAMWAYS.—The recently appointed Transport Advisory Committee in New South Wales has been instructed by the State Government to report on the relative position of tramway and motor omnibus transport, both in Sydney and Newcastle. The Committee is empowered to make recommendations as to whether it would be advisable for existing tramway services to be superseded by omnibuses or *vice versa*.

Bolton.—THE TRANSPORT QUESTION.—The special sub-committee set up by the Tramways Committee to consider the future of the town's passenger transport system has visited Wolverhampton, Birmingham, Nottingham and Chesterfield and inspected the trolley-buses and services in operation in those towns.

The Marchese Marconi's yacht "Elettra" from which ultra-short-wave experimental radio transmissions are being made. The yacht is in the St. Marcus Dock, Venice, near the historic Church of St. Maria della Salute

Canada.—ELECTRIC RAILWAY STATISTICS.—The Dominion Bureau of Statistics at Ottawa, in a preliminary report on the electric railways of Canada for 1931, records a further decrease of 72,223,132 in the passenger traffic, last year's total being 720,468,361. Decreases range from 4.2 per cent. for the British Columbia Electric Railway to as much as 18.5 per cent. for the Calgary municipal system. Three systems ceased operations during the year, one of which, the Hamilton Radial, leased its line to the Canadian National and Toronto, Hamilton and Buffalo Railways. The Toronto Suburban, the Hamilton, Grimsby and Beamsville, and the Sarnia Street Railways were the other lines closed down. The gross revenues of Canadian electric railways amounted to $49,088,310, a decrease of 10.3 per cent., while operating expenses declined by 9.6 per cent. to $35,367,067. The number of employés was reduced from 18,340 to 17,158.

Carlisle.—RAILWAY ELECTRIFICATION SCHEME.—It is understood that a series of consultations between electrical experts regarding the electrification of the London, Midland and Scottish Railway line from Carlisle to Crewe have just been completed and the matter has been referred to financial experts to ascertain the cost of the scheme.

Continental.—RUSSIA.—The plans for the construction of an underground railway at Moscow are reported to have now been completed. It is proposed to establish four generating stations having a capacity of 27,600 kW for the supply of power. The third rail system will be employed and each train will be composed of from six to eight coaches, having accommodation for 334 passengers. Including stops the speed will be 17.36 m.p.h., and the distance between stations will be about 700 metres on the average; escalators will be provided to facilitate traffic movements. It is expected that the first line, which will be about 7¼ miles long, will be completed at the end of 1933.

FRANCE.—The tramcar will soon be a thing of the past in Paris. Fifty of the routes have been abolished since 1925, and now it is announced that within the next 18 months a further 23 routes are to be abandoned. Buses are being substituted.—*Reuter* (Paris).

Glasgow.—ELECTRIFICATION EXPERIMENTS ON THE SUBWAY.—The Corporation is continuing its experiments in connection with the electrification of the subway. The trains are at present worked by a cable system and it is proposed that they should be converted to electric motor operation. The Department generates its own power at Pinkston, and this will be available for the trains if the experiments prove successful.

Japan.—ELECTRIC RAILWAY CHARTERED.—It is announced that the I.G.R. has granted a charter for the operation of the Hakone Mountain Electric Railway for a distance of approximately 3 km. from Odawara to Kazamatsuri. The railway will cost about 650,000 yen.

L.M.S. Railway.—ELECTRIC SIGNALLING EXTENSIONS.—A further stage of the automatic electric colour light signalling which is being introduced between Camden and Watford was brought into operation last Sunday. The new system of signalling has now been extended from Willesden to Kilburn, leaving the sections from Hatch End to Watford and from Kilburn to Camden to be converted later in the year. Since the introduction of this system between Willesden and Hatch End additional trains have been run to and from the West End *via* the Bakerloo Line, and when the installation is finally completed from Camden to Watford, further improvements will be made in the train services of this growing residential area.

London.—TUBE BREAKDOWN.—The failure of the signalling system at Camden Town station just after 8.30 p.m. on Thursday last week caused a hold-up lasting 1½ hours on the Hampstead and Highgate tubes. A restricted service was then resumed but, in spite of all-night work attempting to trace the source of the trouble, it was not possible to run a normal service until 2.30 p.m. the following day.

MORE TRAFFIC SIGNALS.—The introduction of over 200 additional automatic traffic signals at important crossings and junctions in London and the suburbs is expected as a result of the report which will be issued shortly of the committee set up by the Minister of Transport last year to inquire into the whole problem of traffic signals.

Manchester.—TRAFFIC SIGNALS.—The Highways Committee is to provide additional traffic signals at a cost of £1,840.

Southend.—NEW TROLLEY-BUSES.—Four A.E.C.-English Electric 48-seater trolley-buses have been placed in service on new routes, each just over 1½ miles in length, to Eastwood Boulevard and Hamstel Road. The two routes are important factors in the passenger transport co-ordination scheme recently adopted for the borough, and the trolley-buses will henceforth form the sole means of transport in the areas traversed. The vehicles are built to a specification prepared by the tramway manager, Mr. R. A. Fearnley; two-axle chassis have been chosen in view of the characteristics of the routes operated, and on account of the influence of speed on fare collection on the town portion of the journeys. The motor is of the series interpole self-ventilating type capable of developing 80 h.p. at 550 V. For control the contactor method is employed, the solenoid contactors being fitted with blowouts. The contactor case is mounted at one end on to a bracket fixed to the chassis side frame. The master switch for the controller is foot operated and is provided with six notches—five on full field and one on weak field. A reverse is mounted in the same case as the master switch. The rheostatic brake switch is mounted on the cab floor, and the circuit breakers are affixed to the cab ceiling. Also contained in the cab is the trolley change-over switch, current consumption meter, "Leakalarm" indicator, speedometer, lighting switches and fuses. The main power and brake resistances are mounted on the chassis between the side frame with a suitable heat barrier between the top of the resistances and the body flooring. This position ensures adequate ventilation. The collector gear consists of two independent insulated trolleys, having a length of 20 ft., which enables the vehicle to deviate from the centre of the overhead wires by approximately 13 ft. on either side. Wireless non-interference coils are mounted on the roof and built into the trolley base structure. Although large in size they do not detract from the appearance of the vehicles owing to the stream-lined effect of the exterior. In addition to the rheostatic brake, there is a pneumatic brake supplied by a compressor unit driven by a small electric motor. This operates on all four rear wheels. The seating arrangement of the lower saloon (which accommodates 24 passengers) is of conventional type, but upstairs the transverse style has been followed, seats accommodating three and four passengers alternately. A gangway is provided on the offside only. Each saloon has ten lights enclosed in plated fittings. The electricity for these is taken from the normal overhead supply; and there is also an emergency lighting system, the accumulator being trickle charged off the compressor motor circuit.

One of Southend's new trolley-buses

Communications

Australia.—BROADCASTING SERVICES.—Mr. H. P. Brown, the director of postal services, commenting on Captain P. P. Eckersley's recent suggestion for new broadcasting stations on longer wavelengths, said that there was no intention of altering the existing wavelengths. It is understood that a substantial amount has been allowed in the Commonwealth estimates for the current year for the development of broadcasting services. In the plan of 1929 it was estimated that £750,000 was necessary to give a satisfactory service to 95 per cent. of the population.

Replying to Mr. Brown's comments, Capt. Eckersley stated that it was evident that it was not proposed to do anything to improve the Australian broadcasting system—a system which was obsolescent and badly planned. He was, however, not surprised at the attitude taken up, since it agreed with his views that Government Departments were quite unfitted to run the broadcasting service. Only one inference could be drawn from Mr. Brown's attitude, namely, that he did not agree that a long-wave technique would be beneficial to the Australian country listener. In effect, this meant that Mr. Brown and his advisors disagreed with the views firmly held by the thirty or so technicians responsible for all European broadcasting which served 250,000,000 people.

China. — LONG-DISTANCE TELEPHONE EXTENSIONS. — The *Chinese Economic Bulletin* states that in order to bring northern and southern Kiangsu into closer contact, the Provincial Reconstruction Department is planning an extension of the present long-distance telephonic system in southern Kiangsu to six important cities in the northern part of the province. According to present plans, the nine cities of Soochow, Wukiang, Changshu, Wusih, Kiangyin, Liyang, Changchow, Ihing, and Tanyang, in southern Kiangsu, will be linked up with Nantung, Yangchow, Taihsien, Tsingkiangpu, and other important cities of northern Kiangsu.

Great Britain.—RADIO EXCHANGES.—Mildenhall Rural District Council has granted an application by Parker Bros. (Mildenhall), Ltd., to establish a wireless relay service on the housing site at Worlington.

Castleford Urban District Council has sealed an agreement with the local firm of E. Mercer, Ltd., for the establishment of a wireless relay service.

Mr. J. Sweetmore, of Burnley, having applied to the Cleator Moor Urban District Council for permission to establish a relay service, has been informed that subject to a satisfactory demand the scheme will be considered.

Bolton Highways Committee has refused permission to Mr. W. Hallows to operate a relay service in the borough.

TRUNK CALLS "ON DEMAND."—Before the end of the year the G.P.O. is to introduce "on demand" trunk facilities between London and ten of the chief provincial cities. This is the first stage of a scheme for speeding up the trunk services generally.

EXTENSION OF SHIP-SHORE TELEPHONE SERVICE.—It is announced by the Postmaster-General that the radio-telephone service with ships on the North Atlantic route has been extended to the liner *Bremen*. The service now covers the *Empress of Britain*, *Homeric*, *Leviathan*, *Majestic*, *Olympic* and *Bremen*. The charge for a person-to-person call to any of these ships is 12s. a minute when the ship is within 500 miles of Land's End and 24s. a minute at other times. A minimum charge as for three minutes is payable in all cases.

Italy.—NEW SARDINIA CABLE.—A new submarine telephone cable is at present being laid between Terranova in Sardinia and Fiumicino on the mainland. The cable is about 150 miles in length and in parts is laid at a depth of over 3,000 ft. On the Italian side the cable will be connected to the Rome telephone system and in Sardinia with the exchange at Sassari.

Scotland.—THE NEW B.B.C. STATION.—Starting this week, the new Scottish National transmitter, working on a wavelength of 288.5 metres, has been placed in almost complete operation, the principal sections of the programme being broadcast daily. It is expected that the full service will be available by the end of this month.

Spain.—INTERNATIONAL RADIO AND TELEGRAPH CONFERENCE.—Five hundred delegates representing 125 independent states and self-governing colonies met in Madrid on Saturday, when two simultaneous conferences on telegraphy and radio-telegraphy were opened for the purpose of attempting to harmonise international communications. Proceedings started with an inaugural address by Senor Azana, the Spanish Prime Minister, who welcomed the 650 delegates. The agenda includes over 4,000 questions for discussion, and every technical, economic and social aspect of the operation of radio, telegraph or telephone services will be fully examined during the two months allowed for the conference. The telegraph conference will deal with the revision of the International Agreement of St. Petersburg (as it was then known) of 1875, while the radio-telegraph conference will be concerned with bringing up to date the Washington Agreement of 1927. An effort is to be made to co-ordinate telephone and telegraph communication by land and air. The arrival of a Russian delegation of twelve representatives marks an important development, since up to the present Soviet Russia has been prevented for various reasons from joining in international agreements on these matters.—*Reuter* (Madrid).

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Angus.—September 14th. County Council. Electrical work for Birkhill housing scheme. County clerk, County Buildings, Forfar (deposit £1 1s.).

September 22nd. Various works (including electrical) for Hillside (Montrose) housing scheme. County clerk (deposit £1 1s.).

Australia.—MELBOURNE.—October 25th. Post and Telegraph Department. Telephone receivers and parts (A.X. 11452)* and telephone transmitters, &c. (A.X. 11453.)*

October 10th. City Council. Metal-clad switchgear, &c. (A. 11467.)*

SYDNEY.—Department of Public Works. Auxiliary hydro-electric plant for Hume Reservoir. (A.X. 11487.)*

Belgium.—BRUSSELS.—September 26th. Power station for the Hôpital, St. Pierre (estimated cost 1,000,000 francs). M. le President, le Commission d'Assistance Publique de la Ville de Brussels, 46, Boulevard du Jardin Botanique, Bruxelles (A. 11468.)*

LIEGE.—September 10th. Liége University. Turbo-alternator set, with accessories. (G.X. 11785.)*

Dumfries.—September 15th. County Council. Various works (including electric lighting) at Moniaive housing scheme. County clerk, County Buildings, Dumfries.

Dundee.—September 14th. Electricity Department. Erection of Tay Square static sub-station. Mr. D. H. Bishop, general manager and engineer, Dudhope Crescent Road.

Egypt.—ALEXANDRIA.—October 1st. Director-General of Ports and Lighthouses. Electric lighting of the Port of Alexandria. (A. 11462.)*

October 1st. Office of H.M. Yachts. Generating set and electrically driven pumps for the Royal Yacht *Mahronssa*. (G.X. 11778.)*

CAIRO.—October 17th. Director of Stores, Department of Public Health. X-ray apparatus and accessories. (A. 11458.)*

Fife.—September 19th. Miners' Welfare Fund Committee. Heating and electric lighting at Miners' Welfare Institute at Bowhill, Cardenden. Messrs. Muirhead & Rutherford, architects, Dunfermline.

Huyton-with-Roby.—September 21st. Urban District Council. Electrically driven sewage pumping plant. Mr. H. B. Ward, 26, North John Street, Liverpool.

India.—NEW DELHI.—December 5th. Indian Stores Department. A.c. ceiling fans. (A.X. 11461.)*

Kirkcudbright.—September 13th. County Council. L.p. overhead and underground distribution lines and services, 11,000-V underground cables, and a kiosk sub-station. (August 26th.)

Lanark.—September 16th. County Housing Department. Various works (including electric lighting) for fifty-six houses. Mr. P. C. Smith, county housing and town planning engineer, 13, Clydesdale Street, Hamilton.

London.—BATTERSEA.—September 21st. Borough Council. Electric travelling crane and rubber band conveyor. (August 26th.)

METROPOLITAN WATER BOARD.—September 16th. Electrically driven pumps and a 50-kW turbo-generator. Chief engineer, 173, Rosebery Avenue, E.C.1 (deposit £2 2s.).

September 30th. South Indian Railway Co., Ltd. Steel coaches, electrical control and traction equipment. (August 26th.)

New Zealand.—INVERCARGILL.—October 10th. Tramways and Electricity Department. Switchgear (A. 11454)* and single-phase transformers. (A. 11455.)*

WELLINGTON.—October 26th. Post and Telegraph Department. Twenty-four dry electrolytic condensers of 500 mF capacity for use on a 40-V circuit. (A.X. 11478.)*

Oban.—September 30th. Town Council. Oil engines, alternators, cooling tower, travelling crane, mercury arc rectifier kiosks, &c. (September 2nd.)

October 7th. 11-kV and l.p. overhead lines and road work. (See this issue.)

Oswestry.—September 17th. Electricity Department. E.h.p. overhead lines, switchgear, and transformers. (See this issue.)

Portsmouth.—September 19th. Electricity Department. Automatic reversible battery booster and control gear. (August 26th.)

Ramsgate.—September 26th. Town Council. Electrical apparatus for six months. Mr. H. G. Curtis, town clerk, Albion House.

Rosslynlee.—September 24th. Midlothian and Peebles District Asylum. Various articles (including electrical fittings). Mr. C. L. Addison-Smith, clerk and treasurer, 19, Heriot Row, Edinburgh.

Salford.—September 23rd. Electricity Department. 6,600/400-V three-phase power transformers. (See this issue.)

South Africa.—JOHANNESBURG.—September 24th. City Council. 6,600-V and 660-V cables (A. 11457)* and metal-clad switchgear units. (A. 11456.)*

South Shields.—Town Council. Installation of electricity in 120 houses, Green Lane, Tyne Dock. Mr. J. P. Watson, borough engineer, Town Hall.

Warwickshire.—September 10th. County Council. Electric wiring, mains, distribution switchboard, &c., for proposed male children's villa, Weston Colony for Feeble Minded. Mr. A. B. Mallinson, consulting engineer, 44, Brazennose Street, Manchester.

Whitehaven.—Electric Supply Department. E.h.p. and l.p. switchgear, transformers and accessories. (August 26th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Australia.—Clarence River County Council. Accepted. Aluminium cables.—Associated General Electric Apparatus Co. Insulators.—Canney & Towe, Ltd. Switchgear equipment.—Associated General Electric Apparatus and the British General Electric Co., Ltd.—*Tenders.*

Birkenhead.—Electricity Committee. Accepted. Wiring houses on housing estate.—Dow & Co. (£247); S. George (£333); Heaney & Co. (£45); J. J. Peters (£640); G. W. Roberts (£205).

Bolton.—Tramways Committee. Accepted. 250 tons of tramway rails.—Dorman Long & Co., Ltd.

Dewsbury.—Electricity Committee. Accepted. Overhead line at Whitley Lower (£221).—Ward & Co. (Dewsbury), Ltd.

Glasgow.—Corporation Cleansing Committee. Accepted. Electric vehicle batteries (£312 each).—Tudor Accumulator Co., Ltd.

Municipal Transport Committee. Accepted. Tramway street poles.—Stewarts & Lloyds, Ltd. Armature coils.—Manchester Armature Repair Co. Automatic telephone equipment.—Standard Telephones & Cables, Ltd.

Corporation Education Committee. Accepted. Electrical work at schools.—Hamiltonhill (£61).—A. Ritchie. Hamilton Crescent School, Drill Hall (£79) and Collingwood House (£148).—Kennedy, Stark & Co. St. Patrick's Boys' School, temporary extension (£103) and St. George's Road School, manual rooms (£133).—Grindlay, Ross & Co.

Inverness.—Town Council. Accepted. Installation of electric lighting at houses.—Walker & Stanley; R. A. Robertson; Edmundson's Electricity Corporation.

Forthcoming Events

Institution of Mechanical Engineers.—August 19th-September 18th. Canadian summer meeting.

Institution of Electrical Engineers (*North-Western Students' Section*).—Saturday, September 10th. 2.30 p.m. Visit to the works of the Renold and Coventry Chain Co., Ltd., Didsbury, Manchester.

Salford Technical and Engineering Association.—Saturday, September 10th. Royal Technical College, Salford. 7 p.m. "Laboratory and Engine Testing of Lubricants." Mr. F. J. Slee.

Institute of Metals.—September 12th-15th. London. Joint meeting with the Iron and Steel Institute.

Institute of Marine Engineers.—Tuesday, September 13th. Institute, Minories, E.C. 6 p.m. Presidential address by Commander C. W. Craven.

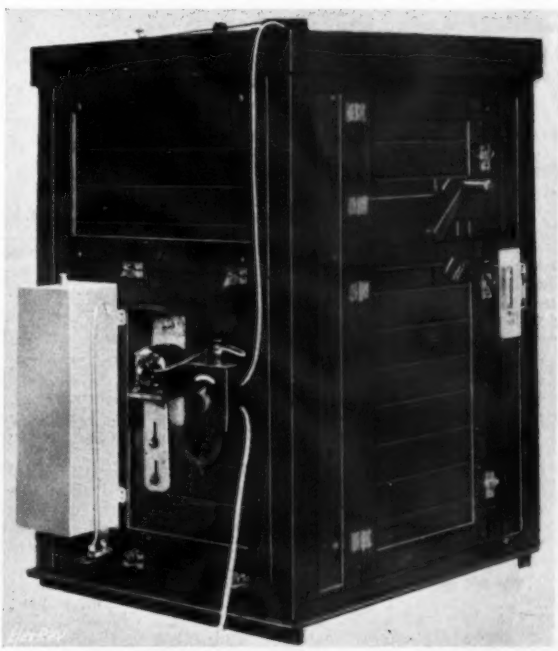
Our Service Department

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the name and address of the makers of the following :—

COLUMBUS electric iron.

Address of the Electro-Osmosis Co.



The "Curfew" cabinet incubator (see page 382)

Notes

An 11-kV Copper-steel Line

The 11-kV line from Maerdy to Troedyrhiw in South Wales, which supplies electricity to Ynysfais Colliery, has recently been completed by British Insulated Cables, Ltd., for the Shropshire, Worcestershire and Staffordshire Electric Power Company.

Owing to the exceptionally mountainous country traversed and the exposed nature of the route, heavy H-pole construction was adopted. An uncommon feature of this line is that it is of copper reinforced with steel, a construction necessitated by the unusually long spans. The conductors are of 6/.147 in. copper and 1/.147 in. steel, giving the equivalent of 0.10 sq. in. copper. In order to deflect the stream of water during heavy rain the suspension insulators are formed of discs of two sizes, the upper of 10 in. and the lower of 7½ in. diameter. The disposition of the conductors is flat, the earth wire running on top of the H-pole above the line conductors and being of the same size as the latter (6/.147 in.+1/.147 in.). An exception to this practice is made in the case of a special pole at the upper end of a 720-ft. span, for which the disposition is triangular, in order to increase the clearances when the line wires are swinging.

Considerable difficulties were encountered in the erection of this line. Some poles were assembled complete and lowered down the hillside to their positions, while in many cases the gear had to be hauled up by horses with blocks and tackle, since it was quite impossible for wheeled traffic to approach the summit.

Some views of this line are reproduced on page 359.

Societies and their Doings, 1932-33

A number of Associations connected with the electrical industry have sent us their programmes for the forthcoming session, the salient features of which are dealt with below :—

The Institution of Engineers-in-Charge announces that a "ladies' night" will be held on Saturday, October 29th, and the thirty-third annual dinner on Friday, March 24th. The president is Mr. Wm. Reavell, the chairman Mr. A. Forbes, and the hon. secretary Mr. A. E. Penn, 100, Earlsfield Road, S.W.18. Social arrangements are in the hands of Mr. A. N. Foster, 86, Lower Road, Rotherhithe, S.E.16.

The inaugural meeting of the 1932-33 session of the Overhead Lines Association is to be held on Wednesday, September 21st, and subsequent meetings on the third Wednesday in each month. The fifth annual conversazione will take place at Harrods' Georgian Restaurant on Friday, November 18th, following a meeting at the I.E.E. at 5 p.m. The hon. secretary is Mr. G. W. Molle, 32, Shaftesbury Avenue, W.1.

The 1932-33 session of the Junior Institution of Engineers will commence on October 7th. The programme for the first half of the session includes a paper, on October 28th, by Mr. R. Gillespie Williams, on "Electrical Engineering as applied to Theatres and Cinemas," and the annual general meeting which will be held on November 11th. On December 9th the inaugural meeting will be held at the Royal Society of Arts, when Sir Alexander Gibb will be inducted as president of the Institution, and will deliver his address.

The winter session of the North-Western Branch of the Institution of Welding Engineers commences on September 28th at the College of Technology, Manchester. Several papers on welding will be read during the session, and the annual meeting will be held on April 19th.

The provisional programme of the Diesel Engine Users' Association, which commences its winter session on October 12th, will include a paper by Mr. W. A. Tookey on "Rated Output of Diesel Engines," which will be read on November 16th, and the Committee's Report on Heavy-Oil Engine Working Costs (1931-32), which will be submitted on December 13th.

The programme for the forthcoming session of the Rugby Engineering Society will include the following :—

October 5th : Presidential address by Dr. F. W. Carter. November 9th : "Industrial Control Gear : Recent Developments," by Mr. G. O. Watson. December 14th : "The Use of Electricity in the Home," by Mr. G. S. Francis. January 18th : "Refrigeration and Thermal Insulation," by Dr. E. Griffiths. March 14th : "Foreign Standards and Regulations in the Light of Electrical Engineering Practice," by Dr. P. F. Stutzl. April 5th : "Light Sensitive Cells," by Dr. F. H. Constable.

The "Model Engineer" Exhibition

The widespread interest taken in model making is being emphatically demonstrated at the annual "Model Engineer" Exhibition now being held at the Royal Horticultural Hall, Vincent Square, S.W.1. There has been a record number of entries in the competition section, and several of them are of electrical interest.

Railways, of course, are responsible for a very large number of the exhibits, and electric locomotives of all sizes are there in abundance; one, stated to be the smallest working model in the world, is driven by a motor one inch long, and weighs only ¼ oz. Boiler and pumping plant are also favourite subjects, and one clever model is of an electric welding shop. Other competition exhibits include electric clocks, an electrical timing device for model power boat racing, Diesel engines, and an accumulator which, though weighing only ¼ oz., is capable of operating a two-valve radio set for half an hour.

Major Raymond Phillips, the inventor, demonstrates a device called a "radio psychometer," by which electrical radiations from the human body can be made to control a model railway or ring a bell. An unusual kind of electric clock is also shown by Dr. B. Winter.

The trade exhibitors include W. T. Henley's Telegraph Works Co., Ltd. (the "Solon" soldering iron); the Economic Electric Co. (electrical novelties, including boat motors, small accumulators and fittings); Stuart Turner, Ltd. (small electrically driven pumping plant, and a 250-W house lighting plant); and Will Day, Ltd. (radio apparatus).

The exhibition closes to-morrow (Saturday).

Electricity Supply Statistics

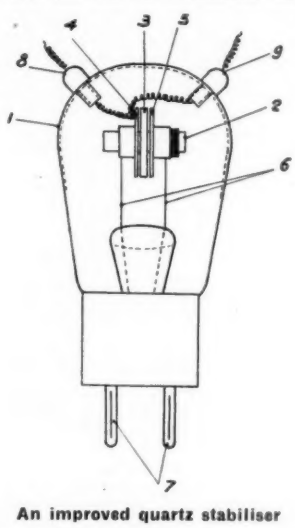
A new volume of the "Return of Engineering and Financial Statistics relating to Authorised Undertakings in Great Britain" was issued by the Electricity Commissioners on Wednesday last. It may be obtained from the Stationery Office at 15s. net. The period covered is the year ended March 31st, 1931 (or May 15th, 1931), for public authority undertakings, and December 31st, 1930, for companies. The return follows the general form of previous publications, and is divided into two main sections: (1) engineering; and (2) financial. A memorandum contains a general review of the detailed statistics.

An Acknowledgement

The picture of York Minster which appeared in our article on the British Association last week was kindly supplied by the London & North-Eastern Railway Company.

The Quartz Radio Stabiliser

The use of a quartz crystal for stabilising radio-frequency circuits is not so simple as it was at first thought to be. Various influences have to be guarded against and with this aim in view the Duc de Grammout recommends placing the crystal between the plates of a condenser (as shown in the accompanying sketch), the special feature of which is that the whole is contained in an exhausted bulb (1) to lessen the influence of variations in the outside temperature and in the viscosity of the air. Without recourse to a thermostat it is thus possible to modify the temperature of the quartz itself at any moment, a thing that constant-temperature circuits cannot do.



An improved quartz stabiliser

The apparatus looks like a lamp bulb, and includes an axis 2 made of insulating material, which axis goes through the quartz, the latter having a hollow centre for the purpose. On the insulated axis are fixed two plates of the condenser (4) and (5) separated by the crystal (3). The plate (5) is threaded to enable it to move along the axle, so as to adjust the condenser to the required capacity. The electrical filaments come out of the bulb through the spindles (6) and (7), and the bulb is also fitted with horns (8) and (9), through which are led the two filaments of a thermo-electric couple, which reaches the same temperature as one of the metal condenser plates. In this way the temperature of a conducting body placed in the immediate vicinity of the crystal can be measured from the outside. The bulb may contain traces of argon which will glow at a certain voltage.

A Battery Drives a Bus

The practice of propelling a bus by means of the starting and lighting battery is not one which is to be recommended, but drastic measures are sometimes necessary in cases of emergency. A report has just been received by the D.P. Battery Co., Ltd., that a breakdown occurred on a bus fitted with one of its "Kathanode" batteries and by engaging first gear and making use of the starter the bus was propelled about three-quarters of a mile to a point where attention could be given. The two-year-old battery with which the bus was fitted withstood the strain without any difficulty and the lighting of the bus was not interfered with.

A Large Oil Engine

The biggest marine oil engine develops about 10,000 b.h.p. In the Hamburg electricity works there is an oil engine of 15,000 b.h.p., and now there has just been completed a Diesel engine of 22,500 b.h.p. for the Copenhagen electricity works. It is of Burmeister and Wain design with eight cylinders, 115 r.p.m., two-cycle, double-acting. It is fully described in the *Motor Ship*, which states that the makers are prepared to build an engine of twice this size. With a load of 15,000 kW the guaranteed fuel consumption is 0.25 kg. of oil per kWh, which is equivalent to 0.396 lb. per b.h.p.-hour.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. M. J. Mortimer, A.M.I.E.E., borough electrical engineer of Morecambe and Heysham, has been appointed borough electrical engineer and general manager of the Loughborough Corporation electricity undertaking, in succession to Mr. S. H. Fowles, whose appointment to the Heston and Isleworth Council was recorded in our issue of August 5th (p. 203).

Mr. Mortimer received his technical training at the Central

[*Press Portrait Bureau.*

Mr. Noel Ashbridge and Sir Charles Carpendale who are representing the B.B.C. at Madrid

Technical Schools, Leeds, the Leeds University, and the Liverpool Technical Schools. He served an apprenticeship with the Midland Railway Co. at Leeds, and was afterwards employed in that company's generating stations at Bradford, Leeds and Heysham Harbour. He subsequently held appointments in the generating stations of the Bury Corporation, the Mersey Railway Co and the Yorkshire Power Co. (Thornhill Station). He was appointed station superintendent at Aylesbury in 1918, and chief assistant engineer at Chelmsford in 1920. This was followed by his appointment as chief engineer and manager to the Abertillery Urban District Council from 1921 to 1928, after which he took up his present position at Morecambe and Heysham. During his stay at Morecambe and Heysham the sales of electricity have increased from 1¾ million kWh per annum to nearly 5 million kWh, while the undertaking has since shown an average net profit of £8,000 per annum.

Mr. H. W. Ashby, mechanical superintendent at the Queen's Road works of Sheffield Corporation Tramways, has been appointed tramway maintenance engineer to the Hull Corporation Transport Department.

Mr. A. Reame, A.M.I.E.E., for many years with Messrs Clayton & Shuttleworth, Ltd., and Messrs. Babcock & Wilcox, Ltd. (Lincoln branch) has commenced practising as a consulting engineer at Monson Chambers, Corporation Street, Lincoln.

Mr. W. A. Barnett, A.M.I.E.E., has been presented by his colleagues at Ocker Hill power station with an oak bureau bookcase on the occasion of his leaving to take up his new appointment as boiler-house superintendent at Ironbridge power station, after twenty-two years' service at Ocker Hill.

The British delegates to the International Radio Telegraph Conference at Madrid left on Thursday last week for the opening of the conference on September 3rd. The leader of the British marine wireless delegation is **Mr. F. S. Hayburn,** deputy managing director of the Marconi International Marine Communication Co., Ltd. He is seen in the accompanying group with Mrs. Hayburn (third and fourth from the left) On the extreme left of the picture are **Mr. R. Ferguson,** joint general manager of the company, and **Commander J. A. Slee, C.B.E.,** technical adviser, who are also members of the delegation.

The British Broadcasting Corporation is represented by **Admiral Sir Charles Carpendale,** the controller, **Mr. Noel Ashbridge,** the chief engineer (whose portraits are reproduced above), and **Mr. L. W. Hayes.**

Mr. G. N. Guest, lately managing director of Messrs. Hollings & Guest, Ltd., and of Messrs. John Hands & Sons, Ltd., has joined Messrs. Tangyes, Ltd. He will supervise inquiries for hydraulic machinery or power presses.

Mr. K. H. Sanders, of the London staff of the Western Electric Co., Ltd., who was recently married to Miss D. M. Kershaw, of Guildford, was presented by his colleagues with cutlery, clocks, and a tray.

Sir Hugo and **Lady Hirst** have returned to London from Aix-les-Bains, where they have been for the past six weeks.

Mr. W. E. Groves, mains engineer for forty years with the Birmingham Corporation Electric Supply Department, has just retired. He was for the first eight years with the old Birmingham Electric Supply Co. when there was only one small generating station in the city. We reproduce a portrait of Mr. Groves with this note.

[*Hudson Studios*

Mr. W. E. Groves of Birmingham

Mr. F. B. Allcock, B.Sc., A.M.I.E.E., elder son of Mr. and Mrs. Harry Allcock, of Hale, Cheshire, was married on September 3rd at St. Paul's, Portman Square, W., to Miss Margaret Williamson.

Mr. J. S. Roper, a member of the staff of the Newcastle-under-Lyme Electricity Department, was recently married at Longton to Miss F. K. Riley. He was presented by his colleagues with an electric reading lamp and an electric kettle.

Mr. T. R. Warren, a member of the staff of the Central Electricity Board, and son of Mr. and Mrs. Thomas Warren, of Norfolk, was married at All Saints' Church, Gosforth, Northumberland, on September 3rd, to Miss Leonora Reid.

Mr. C. Eisler (U.S.A.) who is visiting Europe

Mr. Charles Eisler, president of the Eisler Electric Corporation, Newark, New Jersey, U.S.A., manufacturers of machinery for the production of incandescent lamps, radio tubes, neon signs, electric welding machines, &c., sailed for Europe on August 30th. He intends to make an extensive tour of the Continent and his programme includes a visit to this country. From various inquiries received from several countries, he infers that European business should be larger during the coming year. Mr. Eisler is first to call at Leningrad, to which port his firm has shipped sufficient machines to enable Russian manufacturers to produce more than 150,000 incandescent lamps per day.

At a meeting of Inverness Town Council on September 5th, **Mr. G. C. Maclean** was appointed electrical engineer and manager of the electricity works. Mr. Maclean has been acting in a temporary capacity for the past year. He is a native of Glasgow, and was appointed assistant engineer in 1927.

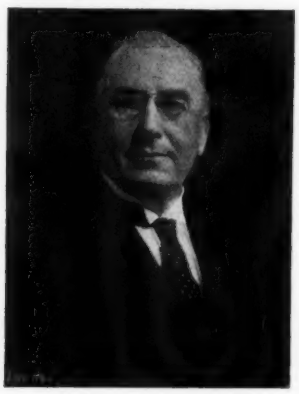
Marine wireless delegates to the Madrid Conference

On September 12th **Mr. B. L. Perkins**, B.Sc., who has resigned from the English Electric Co., Ltd., is joining the staff of the Power Equipment Co., Ltd., as assistant engineer.

We very much regret to learn that **Mr. W. N. C. Clinch**, engineer and manager of the Brighton Corporation Electricity Department, is suffering from the effects of a riding accident which occurred on August 6th near Taunton. For a week he was unconscious in hospital; an X-ray examination revealed a fracture behind the right ear and in addition he sustained a broken collar-bone and several bruises. Mr. Clinch is making satisfactory progress towards recovery, but acting on medical advice he has not yet resumed his professional duties.

Obituary

Mr. H. Embury.—The death occurred at Newton Abbot, on August 31st after a long illness, of Mr. Henry Embury, who for some years had carried on business as an electrical engineer in the town.



[*Lafayette*
The late Mr. M. L. Slattery

Mr. M. L. Slattery.—The death occurred on August 28th, in his sixty-fifth year, of Mr. Michael Lewis Slattery, who for sixteen years had been general manager of the West Ham Corporation Tramways. He commenced his association with tramways in 1884 with the Manchester, Bury, Rochdale, and Oldham Steam Tramways Co., and was afterwards in the Accrington tramway undertaking. From 1891 to 1896 he was an assistant with the Blackburn Corporation Tramways, and subsequently, until 1904, was general manager of the Blackpool, St. Annes and Lytham Tramways Co. He afterwards became general manager of the Oldham Corporation Tramways, a position which he held for seven years, and in 1911 was appointed traffic manager of the London County Council Tramways. In September, 1916, he succeeded Mr. J. S. D. Moffett as general manager at West Ham. He was a member of the council of the Municipal Tramways and Transport Association, and a member of the Institute of Transport.

Mr. J. May.—The death occurred on September 2nd, at the age of 66, at his residence, "Hadlow," Woodlands Road, Bickley, of Mr. John May, M.I.E.E., M.Inst.C.E., after a long illness. The deceased gentleman was a member of the firm of May & Hawes, consulting engineers, of Westminster, and he was or had been a director of various electrical companies, including the Reading Electric Supply Co., the Thames Valley Electric Supply Co., Ltd., also chairman of John Knowles and Co. (London) Ltd. He was elected an associate of the I.E.E. in 1892. The funeral took place on Monday at Chislehurst Cemetery.

Mr. D. Pagan.—The death is reported at the age of 61 of Mr. David Pagan, chief electrical engineer of the East Rand Proprietary Mines, Ltd., at Boksburg, since 1906. Born at Lockerbie, Dumfriesshire, he was for some time with the National Telephone Co., and then with the Natal Telephone Co. at Durban.

Mr. O. Pearston.—We regret to record the death which occurred on Saturday, September 3rd, at North Middlesex Hospital after an operation, of Mr. Osborn Pearston, who, as advertisement representative of the ELECTRICAL REVIEW for many years, was well known in electrical circles until his retirement through illness in the year 1927. The interment took place on Wednesday at Tottenham Cemetery. Mr. Pearston was 66 years of age.

Employés of the Victorian Electricity Commission have contributed £500 for the erection of a memorial to the late chairman, **Sir John Monash**, which is being erected at Yallourn. It has been designed by the Commission's architects, Mr. A. R. La Gerche and Mr. W. E. Gower, and contains a replica of the bust of Sir John Monash by Mr. Paul Montford. It is hoped that the memorial will be completed in time for unveiling on October 9th, the day following the anniversary of Sir John Monash's death.

Will.—Mr. W. Kerfoot, secretary of British Insulated Cables, Ltd., left £42,478 (net personalty £34,455).

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Rhymos, Ltd.—Private company. Registered September 1st. Capital, £4,000 in 2,000 8 per cent. "A" cumulative preference, 200 ordinary and 1,800 5 per cent. "B" preference shares of £1 each. Objects: To carry on the business of electrical contractors, manufacturers and repairers of and dealers in dynamos, motors, batteries, &c. The permanent directors are: J. Christie, "Glyndebourne," Lewes, Sussex, and G. F. Moss, 23, Caxton Road, N.22. Registered office: Blenheim Road, Wood Green.

Convertors, Ltd.—Private company. Registered August 31st. Capital, £1,000 in £1 shares. Objects: To acquire the business of manufacturers of electric clocks and other electric goods carried on by W. W. Nicholson, J. A. Condy and G. H. Nicholson, at 25, Balfour Road, Ilford, as the "Timepiece and General Conversion Co." The directors are: W. W. Nicholson, 85, Beechwood Gardens, Ilford, and four others. Registered office: 21, Beehive Parade, Ilford.

Blakoe Appliances, Ltd.—Private company. Registered September 2nd. Capital, £100 in £1 shares (25 "A," 25 "B," and 50 "C"). Objects: To carry on business as manufacturers of and dealers in electrical machines, apparatus and appliances, &c. The subscribers are: G. I. W. Smith, Holland House, Bury Street, E.C.3, and J. L. H. Blackwood, 38, Newgate Street, E.C. Solicitors: Richards, Butler & Co., Ltd., 1-4, Bury Street, E.C.3.

Patterson Lamps, Ltd.—Private company. Registered September 2nd. Capital, £10,000 in £1 shares. Objects: To acquire the business hitherto carried on by T. A. Jones as Patterson and Company at 40 & 44, Trafalgar Street, Newcastle-on-Tyne, of manufacturers and patentees of miners' safety and other lamps, electrical and general engineers, &c. The permanent directors are: T. A. Jones and Mrs. A. E. Jones, both of Parkrigg, Longtown, Carlisle.

F.A. Wireless Co., Ltd.—Private company. Registered September 1st. Capital, £1,000 in £1 shares. Objects: To acquire and take over the undertaking and all or any of the assets and liabilities of the F.A. Wireless Co., and to carry on the business of letting on hire or sale of all kinds of wireless apparatus and appliances, &c. The life directors are: F. G. Arthurton, 134, Northgate Street, Great Yarmouth; H. Elliott, 29, Benton Street, Birmingham; and P. S. B. Webb, 12, Whalley Road, Whalley Range, Manchester. Registered office: 2, Edgbaston Street, Birmingham.

Battery Service (Yorks), Ltd.—Private company. Registered September 2nd. Capital, £500 in £1 shares. Objects: To carry on the business of electrical engineers, contractors and machinery merchants, manufacturers of and dealers in accumulators, &c. The directors are: R. Winder, Gledhow Hall, Leeds; C. E. Winder, "Ureville," Boroughbridge, Yorks; and E. P. Robson, 12, Luxor View, Harehills, Leeds. Secretary: C. E. Winder. Registered office: Boroughbridge, Yorks.

Stenodia, Ltd.—Private company. Registered September 5th. Capital, £100 in £1 shares. Objects: To carry on the business of agents for, manufacturers, distributors and retailers of, sound and visual reproduction or recording apparatus, &c. The subscribers are: H. FitzPatrick, 49, Manchester Street, W.1, and Mrs. M. W. Furneaux, 76, Norfolk House Road, Streatham, S.W.16. Solicitors: Garton & Co., 21, Maddox Street, W.1.

Brighouse Radio Service & Equipment Co., Ltd.—Private company. Registered September 3rd. Capital, £1,000 in £1 shares. Objects: To acquire the business of wireless dealers, &c., hitherto carried on at Royal Hotel Buildings, Huddersfield Road, Brighouse, as the "Radio Service and Equipment Co." The subscribers are: A. Meads, 5, Green Lane, Hare Edge, Lightcliffe, and A. Gelder, "Newholme," Well Green Lane, Brighouse. Secretary: A. Meads.

Tagg & Ledger, Ltd.—Private company. Registered September 3rd. Capital, £1,000 in £1 shares. Objects: To acquire the business of radio and electrical engineers, factors and dealers carried on by W. Tagg and A. F. Ledger at 73, Porter Street, Sheffield, as "Tagg & Ledger." The first directors are: W. Tagg, 2, Shirehall Road, Sheffield, and A. F. Ledger, 48, Aldred Road, Sheffield. Solicitors: Arthur Neal & Co., 47, Bank Street, Sheffield.

Wessex Ignition Co., Ltd.—Private company. Registered September 3rd. Capital, £100 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, manufacturers of and dealers in electrical and radio apparatus, accumulator parts and accessories, &c. The first directors are: H. Tilbrook, 93, Waterloo Road, Leyton, E.10, and A. R. Kelly, Red House, Quorn, Leics.

Wholesale Service Co., Ltd.—Private company. Registered September 3rd. Capital, £5,000 in £1 shares (3,500 5 per cent. cumulative preference, 500 ordinary, and 1,000 deferred). Objects: To acquire the business of a radio wholesaler carried on by J. Mayer at 178, New Barn Street, Plaistow, E.13. The first directors are: J. Mayer, 178, New Barn Street, Plaistow, E.13, and S. R. Hall, 24, Umfreville Road, Harringay, N.4. Registered office: 178, New Barn Street, Plaistow, E.13.

Ossett Radio Relay Service, Ltd.—Private company. Registered September 5th. Capital, £2,100 in 2,000 7 per cent. cumulative preference shares of £1 and 100 "A" ordinary and 1,900 "B" ordinary shares of 1s. each. Objects: To carry on the business of manufacturers of and dealers in television, electrical and wireless instruments, &c. The directors are: E. N. Kent-Lemon, New Laithes, Horsforth, Leeds, and F. Whitaker, Buckthorne, Seacroft, Skegness. Registered office: 2, Bond Place, Leeds.

Returns of Electrical Companies

Davey, Paxman & Co. (Colchester), Ltd.—Particulars filed of £80,000 debenture stock, authorised August 4th, and covered by trust deed dated August 26th, the amount of the present issue being £78,640. Property charged: Properties in Colchester, five second debentures for £10,000 each in Aldwych House Estates, Ltd., right, title and interest in four like debentures, and the company's undertaking and other property, present and future, including uncalled capital. Trustees: London Trust Company, Ltd. (The deed provides that the company shall be at liberty to create a mortgage, charge or debenture in favour of its bankers, ranking in priority to the above, to secure temporary loans not exceeding £25,000.)

Telephone & General Trust, Ltd.—Capital, £1,300,000 in 550,000 cumulative preference, 450,000 preferred ordinary and 300,000 ordinary shares of £1 each. Return dated March 29th, 1932. 546,767 preference, 427,000 preferred ordinary and 300,000 ordinary shares taken up. £1,197,017 paid on 306,767 preference, 246,767 (plus 1s. premium), 282,000 preferred ordinary and 285,000 ordinary (plus 5s. premium). £160,000 considered as paid on 145,000 preferred ordinary and 15,000 ordinary shares. Mortgages and charges, nil. A return of allotments, made up to July 1st, 1932, shows a further 141 preference shares allotted, payable in cash, and fully called up.

Anglo-Portuguese Telephone Co., Ltd.—Capital, £1,100,000 in 1,000,000 ordinary and 100,000 "A" ordinary shares of £1 each. Return dated August 20th, 1932. 766,092 ordinary and 100,000 "A" ordinary shares taken up. £567,573 paid on 567,573 ordinary shares. £298,519 considered as paid on the remainder. Mortgages and charges, £112,205.

British Ensign Engineering Co., Ltd.—Particulars filed of £8,000 debentures (including £3,500 already registered) authorised August 19th, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £4,500.

Tangyes, Ltd.—Mortgage and charge on properties in Birmingham, Smethwick, and West Bromwich, and the company's undertaking and other property, present and future, including uncalled capital dated August 18th, to secure all moneys due or to become due from the company to the Midland Bank Ltd.

Radiovisor Parent, Ltd.—Debenture charged on the company's undertaking and property, present and future, dated August 24th, to secure all moneys due or to become due from the company to the British Mutual Banking Co., Ltd., not exceeding £10,000.

E. & W. Shepherdson, Ltd.—Capital, £3,000 in £1 shares. Return dated April 25th, 1932. 1,450 shares taken up. £250 paid. £1,200 considered as paid. Mortgages and charges: £350.

Kensington Radio Co., Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1931 (filed April 6th, 1932). 1,150 shares taken up. £2 paid. £1,148 considered as paid. Mortgages and charges, nil.

Stanalite Controls, Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1931 (filed April 1st, 1932). 919 shares taken up. £454 paid. £465 considered as paid. Mortgages and charges, nil.

John Richards & Co. (Electrical Engineers), Ltd.—Capital, £6,000 in £1 shares. Return dated June 24th, 1932. 4,802 shares taken up. £2 paid. £4,800 considered as paid. Mortgages and charges, nil.

J. L. Hills Manufacturing Co., Ltd.—C. R. Odell, 62, Kenneth Road, Chadwell Heath, was appointed receiver and manager on August 24th, under powers contained in debenture dated December 23rd, 1931.

Newquay Electric Light & Power Co., Ltd.—Capital, £50,000 in £1 shares. Return dated May 5th, 1932. All shares taken up. £39,820 paid. £10,180 considered as paid. Mortgages and charges, nil.

Camborne Electricity Supply Co., Ltd.—Capital, £20,000 in £1 shares. Return dated May 5th, 1932. All shares taken up. £20,000 paid. Mortgages and charges, nil.

Sunray, Ltd.—Capital, £2,000 in £1 shares. Return dated March 30th, 1932. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Yeovil Electric Light & Power Co., Ltd.—Capital, £75,000 in £1 shares. Return dated May 2nd, 1932. 65,000 shares taken up. £65,000 paid. Mortgages and charges, nil.

J. W. Scott & Co., Ltd.—H. J. E. Batchelor, 44, Above Bar, Southampton, ceased to act as receiver and/or manager on December 23rd, 1931. (Notice filed August 30th, 1932.)

Pandona, Ltd.—R. V. Newland, Empire House, 159, Great Charles Street, Birmingham, ceased to act as receiver and manager on August 23rd.

Halsey's Electric Co., Ltd.—Capital, £1,000 in £1 shares. Return dated June 30th, 1932. 500 shares taken up. £500 paid. Mortgages and charges, nil.

City Notes

The Jerusalem Electric & Public Service Corporation, Ltd., held its annual meeting in Jerusalem on August 30th, when Mr. L. Le Bouvier, the local director, who presided, read the chairman's speech. In presenting the report and accounts (ELEC. REV., September 2nd, page 341), the chairman said that last year was the first full year in which the Corporation had traded under its own management, and although Palestine had not escaped the severe trade depression, they had made steady progress. They had continued the extension of their system, and to date 24 miles of overhead lines had been erected and 23 miles of underground cables laid. The number of consumers now exceeded 4,300 and applications for a supply of electricity were being steadily received. Negotiations were still being pursued with various prospective large consumers, but it might be necessary to wait for less difficult economic conditions before they could get all of these to sign definite agreements. A supply had now been given to a number of new districts and extensions were in hand which would facilitate the future supply to others. Various additions had been made to the street lighting of Jerusalem and Bethlehem. The new plant was put into commission during the year under review, and they had under discussion with the London managers the provision of further generating plant. This year's summer peak load showed an increase of 16 per cent. over that of the corresponding period of last year, and with the estimated rate of increase maintained, it would in all probability be necessary to install additional plant to meet the peak load during the winter of 1933-34. The trading for the first three months of the current year showed an improvement over that of the corresponding period of last year.

The International Hydro-Electric System reports a consolidated gross revenue of $15,425,260 for the second quarter of 1932, as compared with $12,378,540 in the corresponding period of 1931. The earnings available for dividends on the preferred and class "A" stocks were $348,598, and after providing for the preferred dividends, the balance available for dividends on the class "A" stock was $223,647. The consolidated earnings available for dividends on the class "A" stock for the twelve months ended June 30th were $2,864,672 or $3.34 per share on the average number of shares outstanding during the period. Pending a more definite improvement in business and the completion of the plans for new financing, the directors feel that a conservative policy should be followed with regard to dividend disbursements on the class "A" stock. Unpaid cumulative dividends on this stock from April 1st, 1932, to June 30th, 1932, amount to $429,098.

Companies Struck Off the Register.—The undermentioned companies have been struck off the Register and are thereby dissolved:—

Bishops Castle Electric Light & Power Co., Ltd.
British Power, Traction & Lighting Co., Ltd.
Electrical Contracts & Maintenance Co., Ltd.
F. & E. Stanton.
Fuller's United Electric Works, Ltd.
National Wireless Corporation, Ltd.

Andhra Valley Power Supply Co.—Although its 7½ per cent. ten year sterling notes are redeemable at par in less than eight months' time, the company has decided to take advantage of the present conditions of the Indian money market and has intimated that it is prepared to acquire holdings for redemption now at a substantial premium (probably about 4½ per cent.). The company recently placed a debenture issue in Bombay of Rs. 1,25,00,000, the proceeds of which are to be applied for the repayment of the sterling notes.

The Sun Electrical Co., Ltd., has announced a final dividend of 2½ per cent., less tax, on the ordinary shares, making 5 per cent. for the year (against 7½ per cent.).

The South Metropolitan Electric Light & Power Co., Ltd., has declared an interim dividend of 3 per cent. (same) on the ordinary shares.

Stocks and Shares

TUESDAY EVENING.

SOMETHING more tangible than atmosphere is at work in the markets of the world, which embrace those of the Stock Exchanges in this country, America and the Continent. It was declared at the Ottawa Conference (as at many previous gatherings) that the essential condition of improvement in trade was a rise in commodity prices. How this was to be brought about, the economists were at a loss to define, but in point of fact it has come without much artificial aid. It is, at any rate, pleasant to be able to write about improvements in prices and in the general sentiment current in business circles. The financial policy of the Government in the direction of reducing debt interest is wonderfully assisted by the prevailing conditions of cheap money, anomalous as this may appear in the face of rising prices of commodities and metals. British Government stocks, and such gilt-edged investments as the 4½ per cent. debenture stocks of the electricity authorities are increasing in value, yet, at the same time, the ordinary shares and more speculative issues continue to mount. There is a very unusual activity in the shares of the principal industrial companies. The American Stock Exchange is enjoying a mild boom. Certain of the utility, as well as the railroad, descriptions have more than doubled in price during the past two months.

Home Railway Stocks

So long as the possibility of strike-trouble charges the air, the Underground Electric group will probably continue to be dull, though Districts have risen superior to the apprehension, and at 59½ show a gain of a point. The Piccadilly Line will open, on Monday, September 19th, its new extension from Finsbury Park to Arnos Grove. Five new stations will be available, and will tap districts that are likely to be glad of the service. The market for Home Railway stocks is divided between hopefulness in regard to the growing public feeling of insecurity on the roads; and, on the other hand, caution caused by the constant succession of traffic decreases shown by the leading lines.

London & Suburban preference are better at 10s. Amongst foreign shares, Shanghai Electric Constructions are 2s. 6d. better at 2⅝.

Cables and Wireless

The activity which has developed in other markets seems to have thrown into the shade the popularity which Cables and Wireless stocks have recently been enjoying. Speculation has turned from Cables & Wireless to run into other directions, with the result that the changes in the wireless combine are negligible. Rumours continue to circulate to the effect that a huge merger is contemplated, of which Cables & Wireless will

be one of the principal parties. Oriental Telephones rose ¼ to 52s. 6d., Globe Telegraph & Trust ordinary reacted to £9, a fall of 15s., after the somewhat hectic rise of the week before.

Telephone Rentals 5s. shares can be bought at 4s. 9d., and in view of the progress the company is making, they look fairly attractive. The company paid 6¼ per cent. for the year ended May 31st last, and, according to well-informed quarters, the current year's results are so far better than those of the corresponding period in 1931.

Home Electricity Supply

The market in the leading shares of the home electricity supply companies is steady, but, as so frequently mentioned on previous occasions, the difficulty of obtaining stock in this section militates against freedom of market. There is more elasticity in the dealings in provincial companies' shares than in those of the leading London companies, the latter being held so tightly by investors pure and simple that the shares seldom come in. Clyde Valley have risen 1/16 to 31s. 3d., and Yorkshire Electrics 1s. to 38s. Llanelly ordinary are better at 17s. Amongst fixed-interest shares, Newcastle-on-Tyne preference strengthened to 23s. 3d. City of London Electric preference are marked, in common with the ordinary shares, ex dividend, and are quoted 27s. 6d., the ordinary being 41s. 3d.

There are on offer at the moment, amongst the ordinary shares, 500 Bromptons, 500 Chelseas, and 100 Westminsters, all at 32s. ex dividend. Of St. James' ordinary, 2,500 may be bought at 31s. 3d. The last-named return 4¼ per cent. on the money. A useful line of 5,000 Chiswick Electric Supply ordinary shares has come in at 37s. 6d. Last year's dividend on the ordinary shares was 11 per cent. against 12 per cent. in 1930. In the latter year the capital was increased, and in the five years previously—1925-1929 inclusive—the company had been paying 16 per cent. per annum. It owns the Chiswick Electric Lighting Order of 1891, and the Aberystwyth Electric Lighting Order of 1892. Assuming maintenance of last year's dividend, namely, 11 per cent., the yield on the shares at the present price is £5 17s. 3d. per cent., but if this were to be reduced to 10 per cent., the return would still be £5 6s. 8d. per cent.

The Two Hydros

The International Hydro-Electric system, whose figures have just been published, must not be confused with the Hydro-Electric Securities Corporation, the two being distinct undertakings. The International Hydro-Electric System reports earnings for the twelve months ended June 30th last equal to 3.34 dollars per share, as against 3.39 dollars per share in the previous year.

The Boom in Dollar Shares

The approach of the American elections in November has stimulated the activities of the bull party. The cynic on this side is inclined to think that the prospect of President Hoover being returned to office is likely to be considerably enhanced if the Stock Market is good, and he, the cynic, sees, in the current buoyancy of prices, a political, as well as a financial, indication. This may be taking a rather harsh view of the position, for industrial statistics from the United States favour the impression that a decided change has come over the business outlook in America, and that there is a good deal to be said for the optimistic side. The utilities are in strong request. American Telephone & Telegraph, which last week were 167¼, dipped to 164, and then spurted to 172½. Western Union common are 10 higher at 65. International Telephone & Telegraph, after being below 16, recovered to 19¼. The Latin-Americans are all better. Power Corporation of Canada rose to 21½. Shawinigans have gained 4¼ points, at 27½; Montreal Light & Power are 2½ up at 49. British Columbia Power "A" and "B" shares remained unchanged. Hydro-Electrics jumped to 12¼, but the "B" preferred shares lag strangely behind the common, standing at 7¼. International Holdings are the fraction higher at 2¼. There is a very active and fluid market in these transatlantic favourites, to whose support Brussels has lent persistent aid during the past few days. The Mexican issues have not been neglected. Although Mexico Trams 5 per cent. bonds fell 2 to 27½, Mexican Electric Light first mortgage bonds put on 4 points at 51, and a similar rise advanced Mexican Light & Power second mortgage to the same price. Brazilian Tractions are one of the most popular gambling counters in the Stock Exchange at the present time, and show a gain of ½ at 14¾.

Consolidated Gas & Electric, of Baltimore, at 95 are 20 points up, following their last week's rise of 13½.

The Manufacturing Group

Johnson & Phillips have risen to 20s., showing a half-crown gain. British Insulated are better at 65s., and British Aluminium at 26s. 3d. Of the radio companies' shares, Pye deferred—their nominal value is 1s.—have spurted to 19s. Electric Constructions at 8s. 9d. are 1/16 harder. Brush ordinary has been marked down 8 points, to 32. At this price, a few hardy buyers tried to pick up stock, without great success. Rubber shares spurted upon a jump to 3 1/16d. per lb. in the price of the produce. Earlier this year it touched 1½d. Iron and steel shares have forged ahead. Babcocks show 1/16 rise at 46s. 3d. Vickers hardened a trifle to 7s. 6d. Business in this section, as in most of the markets in the Stock Exchange, has broadened out very considerably during the past few days.

Share List of Electrical Companies

	Nom.	Approx. Dividend. 1930.	1931.	Price. Sept. 6.	Rise. or Fall.	Yield. p.c. £ s. d.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	1	15	15	70/-	—	4 5 9
Brompton Ordinary	1	8½	8½	31/6	—	4 9 0
Central Electricity 4½% Deb.	Stock	4½	4½	102½	—	4 7 10
Charing Cross Ordinary	1	8½	8½	32/-	—	4 7 6
Chelsea	1	8½	8½	32/-xd.	+6d.	4 7 6
City of London	1	10	10	41/3xd.	—	4 16 10
Clyde Valley	1	8	7	31/3	+1/16	4 9 7
County of London	1	11	10½	47/6	—	4 8 5
Edmundsons' 7% Pref.	1	7	7	29/-	—	4 16 7
Elec. Dis. Yorkshire	1	9	9	38/3	—	4 14 1
Elec. Supply Corporation	1	11	11	52/6	—	4 3 10
Kensington Ordinary	1	8	8	33/-	—	4 4 10
Lancs. Light and Power	1	6½	7	28/9	—	4 17 5
London & Home Counties 4½% Deb.	Stock	4½	4½	106½	—	4 4 6
London Electric	1	9	9	32/-	—	4 7 6
Metropolitan	1	10	10	45/-	—	4 9 0
Midland Counties	1	7	7	32/6	—	4 6 2
Mid. Elec. Power	1	8	8	33/3	—	4 16 9
Newcastle-on-Tyne Ordinary	1	6	6	25/9	—	4 13 2
Do. 7% Pref.	1	7	7	31/-	—	4 10 4
Northampton	1	10	10	45/-	—	4 9 0
Notting Hill 6% Pref.	10	6	6	12½	—	4 16 0
North Met. Elec. 6% Pref.	1	6	6	28/-	—	4 5 9
St. James' and Pall Mall	1	8	8	31/-	—	4 10 4
Scottish Power	1	8	—	32/6	—	4 18 6
South London	1	8½	8½	33/-	—	4 10 0
Urban Ordinary	1	7	—	28/9	—	4 17 5
Westminster Ordinary	1	8½	8½	32/-	—	4 7 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	16/3	—	9 4 8
Yorkshire Elec.	1	8	8	38/-	+1/-	4 4 3
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	81½	—	4 18 2
Metropolitan	„	3½	2½	60	—	4 3 4
Do. District	„	5	4½	59½	+1	7 11 3
Underground Electric	1	8	7	17/6	—	8 0 0
TELEGRAPH AND TELEPHONES.						
American Tel. & Tel.	$100	9	9	172½	+5	5 4 4
Anglo-Am. Tel. Pref.	Stock	6	6	102½	—	5 17 1
Do. Def.	„	1½	1½	25½	+1½	5 17 8
Cables & Wireless 5½% Pref.	„	5½	2½	72½	−1	3 15 10
Do. A 7½% Ord.	„	—	Nil	25	−1	—
Do. B Ord.	„	—	Nil	13	—	—
Globe Tel. and T. Ord.	10	8½	Nil	9	−½	—
Do. do. Pref.	10	6	6	11	—	5 14 3
Great Northern Tel.	10	20	20	26	+½	7 13 10
Marconi-Marine	1	15	10	30/-	—	6 13 4
Oriental Telephone Ord.	1	12	12	2½	+½	*4 11 5
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	—	—	3/9	—	—
Do. do. 2nd Pref.	5	—	—	3/9	—	—
Do. do. 5% Deb.	Stock	—	—	7	—	—
British Electric Traction Def. Ord.	„	5	5	300	—	—
Do. do. Pref. Ord.	„	8	8	133½	—	5 19 10
Brazil Traction	100	—	—	14¾	+¼	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	99½	—	5 0 6
London & Sub. Trac. 5% Pref.	1	Nil	Nil	10/-	+6d.	—
London United Tram Deb.	Stock	4	4	61½	—	6 10 0
Mexico Trams, 5% Bonds	—	5	5	27½	−2	18 3 8
Mexican Light Common	100	Nil	Nil	12½	—	—
Do. 7% Pref.	100	7	7	15	—	—
Do. 1st Bonds	—	5	5	54½	—	9 2 0
Victoria Falls Ord.	1	15	15	68/9	—	4 7 3
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	—
MANUFACTURING COMPANIES.						
Assoc. Elec. Ord.	1	6	4	18/9	—	4 5 4
Do. Pref.	1	8	8	31/3	—	5 2 5
Babcock & Wilcox	1	15	14	46/3	+1/16	6 1 9
British Aluminium Ord.	1	10	5	26/3	+1/9	3 16 4
British Insulated Ord.	1	15	15	65/-	+1/16	4 12 4
Brush Ord.	Stock	5	Nil	32	−8	—
Callender's	1	15	15	3	—	5 0 0
Do. 6½% Pref.	1	6½	6½	27/6	—	4 14 6
Crompton Parkinson Ord.	5/-	30	24	18/9	—	6 7 8
Do. 8% Pref.	1	8	8	30/-	—	5 6 8
Edison-Swan 1st. Pref.	1	7½	7½	23/3	—	6 9 4
Do. 5% Deb.	Stock	5	5	100	—	5 0 0
Electric Construction	1	Nil	Nil	8/9	+1/16	—
Enfield Cable Ord.	1	25	25	4½	—	6 1 3
English Electric	1	Nil	Nil	10/9	—	—
Do. do. Pref.	1	Nil	Nil	12/6	—	—
Ever Ready	5/-	35	35	26/-	—	6 14 7
Ferranti Pref.	1	7	7	23/9	—	5 18 0
G.E.C. Pref.	1	6½	6½	28/-	—	4 12 10
Do. ord.	1	10	8	42/-	—	3 16 2
Henley's	1	30	30	5⅛	—	5 1 1
Do. 4½ Pref.	5	4½	4½	4¼xd.	—	4 12 4
India-Rubber	1	Nil	Nil	3/9	—	—
Johnson & Phillips	1	10	5	1	+½	5 0 0
Siemens Ord.	1	7½	7½	23/3	—	6 9 0
Telegraph Construction	12	Nil	Nil	10½	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1931

3543. "Induction furnaces." M. H. Kraemer. February 4th, 1931. (378396.)

3590. "Electron discharge devices of the type in which visible rays are emitted from an electron collecting surface." British Thomson-Houston Co., Ltd., R. C. Clinker, and L. J. Davies. February 4th, 1931. (378397.)

4111. "Electrical switches of the tumbler type." J. A. Crabtree. February 10th, 1931. (378433.)

4160. "Protective arrangements for electric systems." British Thomson-Houston Co., Ltd. February 10th, 1930. (378434.)

7221. "Electrical remote control systems." E. Whitby, I. A. D. Pedler, E. J. Selston, and L. R. Lester. March 9th, 1931. (378435.)

9901. "Air blast electric switches." International General Electric Co., Inc. April 3rd, 1930. (378377.)

12801. "Electric cooking and heating apparatus." C. R. Belling. April 30th, 1931. (378406.)

12881. "Electrode assembly for electron discharge devices." Arcturus Radio Tube Co. May 6th, 1930. (378408.)

13403. "Circuits employing electric discharge devices." British Thomson-Houston Co., Ltd., R. C. Clinker, and H. R. Ruff. May 6th, 1931. (378442.)

13452. "Dry rectifiers." Naamlooze Vennootschap Philips Gloeilampenfabrieken. May 15th, 1930. (378444.)

13591. "Electromagnetically operated relays." H. Lister, F. S. Ash, and Associated Electrical Industries, Ltd. May 7th, 1931. (378447.)

13668. "Electric induction furnaces." Electric Furnace Co., Ltd. May 22nd, 1930. (378448.)

13786. "Electric heating and/or cooking apparatus." British Thomson-Houston Co., Ltd. May 9th, 1930. (378492.)

13796. "Automatic telephone installations." H. Baron (Lorenz Akt.-Ges., C.). May 9th, 1931. (378428.)

13817/8. "Photo-electric devices." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 10th, 1930. (378451/7.)

13821. "Electric switches or circuit breakers, fusible cut-outs, and lightning arresters." British Electrical & Allied Industries Research Association, W. B. Whitney, E. B. Wedmore, and A. M. Cassie. May 9th, 1931 (Cognate application, 7054/32). (378493.)

14029. "Electric cables." Callender's Cable & Construction Co., Ltd., L. G. Brazier, and W. P. Fuller. May 12th, 1931. (378465.)

14111. "Exciting and modulating system for a photo-electric cell." Electrical Research Products, Inc. May 24th, 1930. (378497.)

14251. "Switching mechanisms for use, for instance, in automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd., and E. P. G. Wright. May 14th, 1931. (378505.)

14252. "Electrical communication cable." Standard Telephones & Cables, Ltd., and A. G. Smith. May 14th, 1931. (378506.)

14328. "Electric clocks." Siemens & Halske Akt.-Ges. May 15th, 1930. (378511.)

14396. "Electric supply apparatus." H. G. A. R. Wilson. May 15th, 1931. (378516.)

14434. "Radio apparatus and method of operating the same." J. E. Sampson and J. C. Sampson. June 12th, 1930. (378519.)

14442. "Electrically coating aluminium." W. J. Tennant (Aluminium Colors, Inc.). May 15th, 1931. (378521.)

14472. "Radio and other high-frequency transmitting systems." Marconi's Wireless Telegraph Co., Ltd., D. E. O'Donovan, and L. R. Nixon. May 15th, 1931. (378527.)

14495. "Control boards for electric power networks." Associated Telephone & Telegraph Co. May 31st, 1930 (addition to 2665/31). (378532.)

14800. "Long-distance communication submarine cables." Siemens-Schuckertwerke Akt.-Ges. May 24th, 1930. (378552.)

15004. "Thermally operated overload switches." A. G. Bullen. May 31st, 1931. (378556.)

15171. "Rotary electric switches for wireless receiving apparatus." General Electric Co., Ltd., and S. G. Hunter. May 22nd, 1931. (378562.)

15407. "Radio direction finders." Kolster-Brandes, Ltd. May 26th, 1930. (378566.)

15410. "Braking devices particularly applicable to electric switches." General Electric Co., Ltd., H. C. Turner, and L. Aldred. May 26th, 1931. (378567.)

15872. "Electric batteries." Van Raden & Co., Ltd., and J. P. Starley. May 30th, 1931. (378570.)

16305. "Means for protecting electric lines with impedance relays." Siemens-Schuckertwerke Akt.-Ges. June 5th, 1930. (378574.)

16815. "Electric stop actions for organs and the like." J. Compton Organ Co., Ltd., and J. I. Taylor. June 9th, 1931. (378579.)

17180. "Electrical measuring instruments." Ferranti, Ltd., and G. L. Porter. June 12th, 1931. (378583.)

17232. "Automatic and semi-automatic telephone systems and the like." Siemens Bros. & Co., Ltd., W. G. Patterson, D. A. Christian, and W. H. Grinstead. June 13th, 1931. (378585.)

17234. "Automatic telephone systems." Siemens Bros. & Co., Ltd., and D. A. Christian. June 13th, 1931. (378586.)

17235. "Automatic telephone systems." Siemens Bros. & Co., Ltd., and W. G. Patterson. June 13th, 1931. (378587.)

18676. "Dynamo-electric machines." W. E. Evans (Allgemeine Elektricitats-Ges.). June 27th, 1931. (378607.)

18777. "Variable capacity electrical condensers." Lotus Radio, Ltd., and F. G. Stokes. June 29th, 1931. (378609.)

20860. "Dynamo-electric machines." E. W. Moss (J. W. Burleigh). July 21st, 1931. (378624.)

21930. "Protection of electrical conductors against glow discharge." Siemens-Schuckertwerke Akt.-Ges. August 7th, 1930. (378634.)

22188. "Poles for the support of electric transmission lines." Callender's Cable & Construction Co., Ltd., P. V. Hunter, and C. O. Boyse. August 5th, 1931. (378635.)

22431. "Electrical rectifiers." Siemens & Halske Akt.-Ges. August 7th, 1930. (378637.)

22492. "Electric switches or circuit breakers." British Electrical & Allied Industries Research Association, W. B. Whitney, E. B. Wedmore, and A. M. Cassie. May 9th, 1931 (Cognate application 22502/31). (Divided application on 378493.) (378471.)

22707. "Directional wireless radiating systems." Radio-Austria Akt.-Ges. March 6th, 1931. (378642.)

23925. "Manufacture of thermionic cathodes for electric discharge devices." M-O Valve Co., Ltd., W. H. Aldous, and J. F. Jackson. August 25th, 1931. (378651.)

24572. "Tubular high-tension condensers." Meirowsky & Co. Akt.-Ges. September 2nd, 1930. (378656.)

24586. "Miners safety and other electric battery lamps." Oldham & Son, Ltd., and H. Holt, jun. September 1st, 1931. (378657.)

1932

441. "Electrical signalling systems." Associated Electric Laboratories, Inc. February 20th, 1931. (378762.)

3082. "Marine telephone cable installation." Felten & Guilleaume Carlswerk Akt.-Ges. February 28th, 1931. (378786.)

3687. "System for electrically distributing music or speech over a network of mains." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 5th, 1931. (378789.)

3998. "Audio-frequency distribution systems." Marconi's Wireless Telegraph Co., Ltd. March 20th, 1931. (378792.)

8675. "Electric time-switches." C. Snay. March 25th, 1931. (378824.)

8837. "Lead electrical storage batteries." Britannia Batteries, Ltd. March 24th, 1931. (378825.)

9165/6. "Synchronising devices with a controlled oscillation generator, especially for television apparatus." Fernseh Akt.-Ges. April 4th, 1931. (Addition to 366598.) (378826/7.)

10749. "Wireless direction-finding apparatus." Telefunken Ges. fur Drahtlose Telegraphie. April 14th, 1931. (378831.)

14175. "Means for mounting electric switches and the like in wall-boxes." General Electric Co., Ltd., and J. H. Collings. May 13th, 1931. (Divided application on 14654/31.) (378842.)

20433. "Electric switches of circuit-breakers, fusible cut-outs, and lightning arresters." British Electrical & Allied Industries Research Association. W. B. Whitney, E. B. Wedmore and A. M. Cassie. May 9th, 1931. (Divided application on 378493.) (378535.)

25715. "Electric discharge tubes." Naamlooze Vennootschap Philips Gloeilampenfabrieken. October 13th, 1930. (378672.)

26505. "Cathode ray tubes, especially for television purposes." U. W. Doering. September 24th, 1930. (378681.)

27361. "Carrier-current signalling systems." International General Electric Co., Inc. October 2nd, 1930. (378686.)

27652. "Means for preventing disturbances in thermionic amplifiers." Siemens & Halske Akt.-Ges. October 4th, 1930. (378691.)

28300. "Electric regulating switches." Allmänna Svenska Elektriska Aktiebolaget, A. Schaanning, and H. Nutt. October 12th, 1931. (378697.)

28332. "Variable condensers and circuits for use therewith." Marconi's Wireless Telegraph Co., Ltd. October 11th, 1930. (378698.)

28958. "Ignition devices for high power arc lamps." C. Zeiss. October 23rd, 1930. (378704.)

29061. "Methods and means for finding the direction of flow of electrical energy." Elliott Bros. (London), Ltd., and G. F. Shotter. October 20th, 1931. (378706.)

32787. "Mercury-vapour rectifiers." Akt.-Ges. Brown Boveri et Cie. January 26th, 1931. (378728.)

33562. "High-frequency signalling systems." Hazeltine Corporation. January 28th, 1931. (378733.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 31st:—

Marelli. No. 530877. Class 6. Electric fans, motors and polishing machines.—Marelli & Co., Ltd., 19-20, Garlick Hill, Queen Victoria Street, E.C.4.

Katazone. No. 532726. Class 6. Electrical machines and parts thereof for drying printer's ink and eliminating static electricity in paper and textiles.—Sheridan Machinery Co., Ltd., 43, Gray's Inn Road, W.C.1.

The Choice of Critics (lettering and design). No. 531615. Class 8. Apparatus for use in radio-telegraphy and telephony.—A. F. Bulgin & Co., Ltd., Abbey Road, Barking, Essex.

Atmalloy. No. 531777. Class 8. Telegraph, telephone, signalling and radio-telephone instruments and apparatus and parts thereof, &c.—Automatic Electric Co., Ltd., Strowger Works, Milton Road, Liverpool.

Lumar. No. 533115. Class 8. Spectacles having affixed thereto a small electric lamp to assist the wearer in reading and the like.—G. H. Wingate, 40, Chester Terrace, Regent's Park, N.W.1.

Micromite. No. 534044. Class 8. Electric transformers, instruments and apparatus and parts thereof for use in radio-telegraphy and telephony, television and sound recording and reproducing, &c.; and Micronetic. No. 533764. Class 13. Laminations of ordinary metal for magnetic fields.—H. N. Moss, Town End, Portsmouth Road, Kingston-on-Thames.

Diatatic. No. 532175. Class 11. Electrical apparatus for therapeutic purposes.—W. E. Holder, 19, Westbourne Park Road, W.2.

Lovol. No. 531938. Class 13. Electric lamps (ordinary).—A. E. Chapman, 125, Stanley Park Road, Carshalton, Surrey.

Rockite. No. 533178. Class 50. Synthetic resins in solid form and mouldable powders of synthetic resins for electrical insulating purposes.—Rockhard Resins, Ltd., 204-206, Great Portland Street, W.1.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Houses (150), Hilton; John Bisset & Sons, Ltd., builders, Great Northern Sawmills.

Aberystwyth.—Convent school, Llanbadar Road; Hallwoods, Ltd., Bennett Street, Hyde.

Aldershot.—Electricity showrooms for the T.C.; H. G. Baker, architect, 41, Grosvenor Road.

Alnwick.—Housing scheme for the R.D.C. (£50,000).

Beaminster (DORSET).—Houses (20) for the R.D.C.; C. K. Jupp, architect, 10, South Street, Bridport.

Becontree (ESSEX).—Church of St. Nicholas; Boyd & Murley, Ltd., builders, Reading.

Berwick-upon-Tweed.—Swimming baths for the T.C.; G. R. Davidson, surveyor, Town Hall.

Bilston.—Houses (176); U.D.C. surveyor.

Birkenhead.—Chapels (3) and crematorium, Landican cemetery; borough surveyor. Alterations, Hippodrome Theatre, Grange Road; Hippodrome Co. Development of portion of Walker Park Estate, Prenton; Layton & Co.

Birmingham.—Extensions to the Uffculme Convalescent Home, Kings Heath; G. Webb & Son, Ltd., builders, Soho Road.

Blackburn.—Greyhound Club buildings and racing track off Hill Street, Furthergate; Foden, Hemm & Williams, architects, 199, Deansgate, Manchester.

Blyth.—Houses (50), Bebside; L. Leeper, borough engineer, Town Hall.

Bootle.—Extensions to infectious diseases hospital, Linacre Lane; W. A. Harrison, borough surveyor, Town Hall.

Burnley.—Houses (80), Stoops Estate; borough engineer. Works extension, Accrington Road; W. D. Dean & Sons, Ltd.

Carnarvonshire.—Central school, Bangor; county architect, W. Lloyd Jones, County Offices, Carnarvon.

Chatham.—School, Corkwell Farm, for the Borough E.C.; A. J. Harris, clerk.

Cheltenham.—Partial reconstruction of hotel, Clarence Street; Carrs Hotel, Ltd.

Chesterfield.—Houses (57) for the T.C.; Harry Clayton, 12, Corporation Street, and Rollinson & Son, 10, Corporation Street, architects.

Cranleigh (SURREY).—Public hall (£3,637); Auchterlonie & Reeves, builders.

Derbyshire.—Medical officer's residence, Bretby Orthopædic Hospital; county architect, Derby.

Doncaster.—Rehousing scheme (78); borough surveyor. Extensions, Intake school (£9,777), for the Borough E.C.; Walter Firth, Ltd., builders. Houses (164) for Thomson & Dixon (Doncaster), Ltd.; Greenfield Lane, houses (250), for the T.C.; F. Haslam, Ltd., builders.

Dumfries.—Houses (96) (£36,000); borough surveyor. Houses, Moniaive, with electrical work; John Robson, county clerk, Dumfries.

Earl Shilton.—Additions to works, Keats Lane, for the Midland Paper Staining Co., Ltd.; E. H. Crump, architect, Barclay's Bank Buildings, Hinckley.

Eastbourne.—Alterations, Ear, Nose and Throat Hospital, Pevensey Road; F. G. Cooke, architect.

Eastry.—Six children's homes (£12,478), for Kent P.A.C.; county architect, Maidstone.

Edinburgh.—Shops (22) with offices above, Leith Walk; H. Gildard White, architect, 68, Merchiston Avenue.

Elland (YORKS).—Houses (54); U.D.C. surveyor.

Ellesmere Port & Whitby.—Houses (100), for the U.D.C.; Alun Edwards, Ltd., builders, Cefn-y-Bedd, Wrexham.

Exmouth.—Pavilion (£10,000); U.D.C. surveyor.

Fifeshire.—Houses (86) for Lochgelly T.C.

Fleetwood.—Houses (100), Flakefleet Estate, and Floral Hall; U.D.C. surveyor.

Glasgow.—Houses (336) for Corporation; architect, Housing Department. Cinema, Balmore Road, Possillpark; John M'Kissack & Son, architects. Factory extension, Munro Place, Anniesland; Birrell, Ltd. Church, Saracen Street; R.C. Archbishop of Glasgow. Extensions, Morrison Street; Scottish Co-operative Wholesale Society, Ltd.

Gloucester.—Aerodrome; Corporation.

Greenhithe.—Offices, High Street; F. T. Everard & Sons.

Harrogate.—Factory premises for the West Yorkshire Road Car Co.; J. Houfe, architect, Albert Street, Harrogate.

Hastings.—Re-erection of works, Rock Lane, Ore, for the Ore Brickfield Co., Ltd.

Hendon.—Extensions, Isolation Hospital; U.D C. surveyor.

Horden (Co. DURHAM).—Re-erection of premises, Cotsford Lane, for J. Wrathal (£3,000).

Horsham (SUSSEX).—Houses (100) for the U.D.C.; Grosvenor Construction Co., Ltd., builders, London.

Hucknall.—Houses (48), Brookside Estate; H. M. Aitchison.

Hyde.—Houses, Slat Acre Estate, Gee Cross; F. Booth & Son. Cubicle block, Hospital; borough engineer.

Inverness.—Houses (56) (£20,000); borough surveyor.

Isle of Man.—Extensions, Cronk Ruagh Sanatorium, Lezayre, for the Government Property Department; B. E. Sargeaunt, Government secretary and treasurer, Government Office.

Jarrow-on-Tyne.—Houses (30), Primrose Hill; J. Scott-Weir, borough engineer. Town Hall.

Kent.—Remodelling Coxheath Institution, with boiler house and laundry block and engineering work (£25,000), for the P.A.C.; county architect, Maidstone.

Kirkintilloch.—Houses, Gallowhill (24) and Woodhead (48); J. Coates, borough surveyor.

Knutsford.—Extensions to works for the Knutsford Paper Works, Ltd.; A. Clayton, architect, Duchie Chambers, Clarence Street.

Leadgate.—Central premises for the Leadgate Industrial and Provident Society, Ltd.; Architects' Department, Co-operative Wholesale Society, Ltd., Newcastle-on-Tyne. Houses (33) for the U.D.C.; R. Carse & Sons, builders, Amble, Northumberland.

Leek (STAFFS).—Houses (40), Haregate Estate; U.D.C. surveyor.

Lichfield.—Erection of the Lichfield Victoria Hospital, Birmingham Road; J. R. Deacon, builders, Lichfield.

Liverpool.—Additions to St. Anne's Schools, Chatham Place; Foden, Hemm & Williams, architects, 199, Deansgate, Manchester.

Manchester.—Rebuilding premises for John Fenton, Ltd., Ford Lane, Pendleton; W. H. Longworth, architect, 4, St. Mary Parsonage. Cinema, off Stockport Road; W. Thornley, architect, Clarence Chambers, 46a, Wallgate, Wigan. Rebuilding office block, Mosley Street and Booth Street, for Rev. E. A. Milnes and C. B. Cooke; Earle Estate Office, Ltd., 49, King Street. Extensions, Wellington Inn, Chancery Lane, Ardwick; F. Riley, County Buildings, 4, Cannon Street.

Malmesbury.—Houses (24); R.D.C. surveyor.

Middlesbrough.—Conversion of Acklam Hall as a secondary school for boys; S. E. Burgess, borough engineer, Town Hall.

Newcastle.—Houses (400), Scotswood and Stamfordham Estates; city architect.

Newhaven (SUSSEX).—Houses (70), Gibbon Road; Workmen's Housing Association, Ltd.

Northampton.—Factory, Grafton Street; John Leighton, Ltd., St. George Street.

Norton (YORKS).—Housing scheme (£13,512); U.D.C. surveyor, Council Offices.

Northants.—Casual wards (£26,000); county engineer.

Ossett (YORKS).—Church of St. Ignatius, Storrs Hill Road, South Ossett; Henry Fallas & Sons, builders, Horbury, near Wakefield.

Peterborough.—Telephone exchange for H.M. Office of Works; Earnshaw & Sons, builders, Darlington.

Plymouth.—Houses (215), flats (28), Barne Barton Estate; Reeves, Charlesworth, Ltd.

Poole.—Church of St. George, Oakdale; H. Kendall, architect, 51, Towngate Street.

Portadown (Co. ARMAGH).—Branch bank premises, High Street, for Ulster Bank, Ltd., Waring Street, Belfast; McAuley, McIlroy & Co., builders, 2, Windsor Road, Belfast.

Pontefract.—Hotel premises, Wagon Lane, Upton; Hustler & Taylor, architects, 45, Ropergate.

Prestwich.—Synagogue and Hebrew school, King's Road, Sedgeley Park; W. R. Sharp & Cowburn, architects, 40, South King Street, Manchester.

Rawtenstall.—Additions for J. R. Myerscough & Sons, Ltd., Hollymount Garage; A. Brocklehurst, architect, St. James Buildings, Waterfoot.

Rotherham.—Extensions, St. Catherine Hospital; V. Turner.

Runcorn.—Council chamber and offices; J. O. Hunter, R.D.C. surveyor.

Seahouses (NORTHUMBERLAND). — Harbour improvement scheme (£25,000); Holloway Bros., contractors, 24, Grey Street, Newcastle.

Slough.—Public offices; U.D.C. surveyor. Lido establishment, Bath Road (£20,000), for Town & Country Road Houses, Ltd.; P. Ellis & Co., Bath Road.

Southport.—House and dairy buildings, Lytham Road; N. Wright.

South Shields.—Houses (366) for the Sutton Dwellings Trust Scheme; C. S. Errington, architect, 21, Grainger Street West, Newcastle.

Stratford-on-Avon.—Extensions to premises of the National Farmers' Union Mutual Insurance Society, Ltd., Church Street; F. W. B. Yorke, architect, 380, Paradise Street, Birmingham.

Sunderland.—Houses and shops, Sidcliffe Hall Estate; G. T. Brown, architect, Fawcett Street. Rebuilding Manor Hotel; Hill and Honeyman, architects, 6, Eldon Square, Newcastle. Rebuilding Wearmouth Bridge Inn; Hetherington and Wilson, architects, 52, Westgate Road, Newcastle.

Swadlincote.—Houses (64), Nelson Street site; U.D.C. surveyor.

Redditch.—Paper store, Park Road; Harris & Walford. Factory extension; A. Rudge.

Salford.—Flats (265), Seedley Road, for the Sutton Trust; secretary.

Southport.—Estate development, Dunbar Road and Arundel Road; T. & W. Rimmer.

Tamworth (STAFFS).—Houses (88), Wilnescote; W. Powell, R.D.C. surveyor. Buildings, Marshall's Court and Church Street; Architect's Department, Co-operative Wholesale Society, Ltd., 1, Balloon Street, Manchester.

Torquay.—Reconstruction, Royal Theatre (£10,000 to £15,000), for W. G. & E. J. Vickery, Ltd.; E. J. Vickery, managing director. Development of Cockington Estate; Gilbert H. Jenkins, architect.

West Riding.—Junior school, Cottingley, for the County E.C.

West Ward (WESTMORLAND).—Houses (40) for the R.D.C.; A. Knewstubb, architect, St. Andrew's Chambers, Penrith.

Whitehaven.—Warehouse for Smith Bros. (Whitehaven), Ltd., printers, North Shore Works; J. S. Stout, architect, 36, Lowther Street.

Whitwood (YORKS).—Houses (20) for the U.D.C.; R. A. Easdale, architect, County Chambers, Castleford.

Willesden.—Shops, North Circular Road; Done, Hunter & Co. Block of flats, Coles Green Road; R. Costain & Sons.

Wortley (YORKS).—Houses (36) for the R.D.C.; S. G. Bailey, Sheffield (26), and G. L. Bradshaw, Ecclesfield (10), builders.

Wrexham.—Houses (80), with electrical work, for the R.D.C.; D. E. Edwards, acting engineer, Imperial Buildings.

York.—Re-erection of printing works, North Street, for Ben Johnson & Co., Ltd., Micklegate (£80,000).